Model 7300

Service Manual

Aug 27, 1999

Part Number 9226-90-00

Novametrix Medical Systems Inc.
P.O. Box 690
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Service Policy

Novametrix Medical Systems Inc. provides 24-hour a day access to technical support through its Technical Support Department in Wallingford, Connecticut, and company Service Representatives located throughout the United States. (Outside the U.S., primary technical support is handled through our qualified international sales and service distributors.)

Novametrix will provide Warranty Service support within 48 hours of receiving a request for assistance. Contact the Technical Support Department by telephone toll free at 800-243-3444, or 203-265-7701; by facsimile at 203-284-0753; or, by e-mail at techline@novametrix.com. After hours telephone support requests (before 8:00 AM and after 5:00 PM Eastern Time) will be responded to promptly by the Technical Support on-call staff. After hours facsimile and e-mail requests will be answered the next business day. It is suggested that any person calling in for technical support have the equipment available for product identification and preliminary troubleshooting.

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techline@novametrix.com

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Table of Contents

Safety **1**
- Warnings 1
- Cautions 2
- Notes 2

Introduction **5**
- About this manual 5
- Front and Rear Illustrations 5
- NICO Monitor Technical Description 6
- Manufacturing Quality & Safety 6
- Declaration of Conformity with European Union Directive 6
- Trademarks and Patents 6
- Manual Revision History 6

Theory of Operation **7**
- NICO Model 7300 Non-Invasive Cardiac Output Monitor 7
- Digital Board 2763 7
  - Microprocessor 7
  - Background Mode Debugging and Application Development 11
  - System Memory 11
  - User Interface Control Circuitry 12
  - Real Time Clock, Power on RESET Generation and Glue Logic 12
- Power Supply 2764 (Power Supply and Communications) 13
  - Serial Communications UART 13
  - CO_2 Pulser Source Drive 15
  - CAPNOSTAT Case and Detector Heater Control 16
  - Saturation LED Power Generation and LED Drive 17
  - Power Supply and Voltage Reference Generation 17
  - Logic and Input / Output Signal Control 20
- Analog Board 2765-01 20
  - CAPNOSTAT Interface 20
  - CO_2 Input Signal Path 20
  - CO_2 Case and Detector Heater Regulation 21
  - Flow Zeroing and Patient Line Purging 22
  - Flow Circuitry 22
  - Barometric and Airway Pressure 23
  - Patient Airway Adapter Type Sensing 23
  - NICO Sensor Rebreathing Valve Control 24
  - Saturation Input Signal Path and Signal Conversion 24

Functional Testing **25**
- Equipment Required 25
- Functional Test 25

Accuracy Tests **29**
- Equipment Required 29
- CO_2 Testing 29
- SpO_2 Testing 30
- Flow Testing 31
- Time / Date Setting 31

Electronic Tests **33**

CE
0086

Equipment Required 33
Power Supply 34
Voltage Checks 35
CO_2 Testing 37
SpO_2 Testing 37
Flow, Barometric Pressure and Rebreathe Valve Testing 38
Serial / Analog Testing 40
Safety Testing 40
Maintenance 41
General 41
Maintenance Schedules 41
Cleaning and Sterilization 41
Monitor 41
SpO_2 Finger Sensor 41
SpO_2 Y-Sensor 42
SpO_2 Y-Strip Tapes and Foam Wraps 42
Ear Clip 42
NICO Sensors 42
CAPNOSTAT CO_2 Sensor 42
Disassembly 43
Equipment Required 43
Disassembling Unit 43
Reassembling Unit 44
Battery Maintenance 44
Replacing the Internal Battery 44
Mains Voltage Configuration 45
Fuse Replacement 46
Software Update Instructions 47
Equipment Required 47
Setup 47
Procedure 48
Specifications 51
General 51
NICO 51
CO_2 51
Flow Sensor 52
SpO_2 52
Monitor Specifications 52
NICO Accessories 53
Parts Lists 55
9226-00 Non-Invasive Cardiac Output Monitor, Model 7300 55
9226-01 Main Assy 55
2763-01 Digital Board Assy 56
2764-01 Power Board Assy 58
2765-01 Analog Board Assy 62
2766-01 CO_2 Input Board Assy 65
9392-01 Pump W Rsvr Assy 65
Drawings 67

1 Safety

For maximum patient and operator safety, observe the following warnings, cautions and notes.

1.1 Warnings

WARNING:
Indicates a potentially harmful condition that can lead to personal injury.

- Explosion Hazard: Do not use the NICO monitor in the presence of flammable anesthetics. Use of this instrument in such an environment may present an explosion hazard.
- Electrical Shock Hazard: Always turn the NICO monitor off before cleaning it. Do not use with a damaged external power source. Refer servicing to qualified service personnel.
- Connect the AC Mains power cord to a properly grounded hospital-grade outlet. The NICO monitor should be connected to the same electrical circuit as other equipment in use on the patient. Outlets of the same circuit can be identified by members of the hospital's engineering department.
- Failure of Operation: If the monitor fails to respond as described, do not use it until the situation has been corrected by qualified personnel.
- Reuse (disassembly, cleaning, disinfecting, resterilizing, etc.) of the NICO sensor may compromise the device functionality and system performance and cause a potential patient hazard. Performance is not guaranteed if the NCIO sensor is reused.
- Inspect the CO_2, SpO_2 and NICO sensors prior to use. Do not use if they appear to be damaged or broken.
- Do not attempt to rotate the NICO sensor in the breathing circuit by grasping the pneumatic tubes exiting the flow sensor.
- Do not apply excessive tension to any cable or the NICO sensor pneumatic tubing.
- Periodically inspect NICO sensor tubing lines for kinks.
- Replace the NICO sensor if excessive moisture or secretions are observed in the tubing.
- Do not use the NICO monitor if it is unable to properly identify the NICO sensor. If the condition persists, refer the monitor to qualified service personnel.
- The NICO sensor connector should be properly inserted into the front panel receptacle prior to connecting the NICO sensor to the breathing circuit, in order to avoid a circuit leak, or occlusion of the NICO sensor tubing.

- In the event the message **NICO SENSOR FAILURE** is displayed, remove the NICO Sensor from the patient circuit.
- Patient Safety: Care should be exercised to assure continued peripheral perfusion distal to the SpO_2 sensor site after application.
- Inspect the SpO_2 sensor site for adequate circulation at least once every four hours.
- When applying sensors take note of patient's physiological condition. For example, burn patients may exhibit more sensitivity to heat and pressure and therefore additional consideration such as more frequent site checks may be appropriate.
- Do not position sensor cables or tubing in any manner that may cause entanglement or strangulation.
- The NICO monitor is not intended to be used as a primary apnea monitor.

1.2 Cautions

CAUTION:
Indicates a condition that may lead to equipment damage or malfunction.

- Use only Novametrix approved sensors and accessories with the NICO monitor.
- Do not operate the NICO monitor when it is wet due to spills or condensation.
- Do not operate the product if it appears to have been dropped or damaged.
- Never sterilize or immerse the monitor in liquids.
- Do not sterilize or immerse sensors except as directed in this manual.
- No tension should be applied to any sensor cable or tubing.
- To avoid the effects of excessive moisture in the NICO sensor, insert it in the ventilator circuit with the pneumatic tubes upright. Excessive moisture in the NICO sensor may affect the accuracy of the measurements.
- Operate the monitor at temperatures between 10 to +40° C (50 to 104° F), 10-95% R.H. non-condensing.
- Avoid storing the monitor at temperatures less than -10° C or greater than +55° C (<14° F or >131° F) 10-95% R.H. non-condensing
- Observe precautions for electrostatic discharge (ESD) and electromagnetic interference (EMI) to and from other equipment.
- Where electromagnetic devices (i.e., electrocautery) are used, patient monitoring may be interrupted due to electromagnetic interference. Electromagnetic fields up to 3 V/m will not adversely affect system performance.
- Caution: Federal (U.S.A.) law restricts this device to sale, distribution, or use by or on the order of a licensed medical practitioner.

1.3 Notes

NOTE:
A point of particular interest or emphasis intended to provide more efficient or convenient operation.

- In order to ensure proper monitoring of oxygenation and ventilation:
  - The use of pulse oximetry is recommended during NICO monitoring.
  - Setting of $ETCO_2$ and SpO_2 alert limits is recommended.

- A “NO RESPIRATION” alert is not generated when both the CAPNOSTAT CO_2 sensor and the NICO sensor are disconnected from the NICO monitor.
- Be certain that the monitor is not in Demo Mode while monitoring. Demo Mode can be identified by the flashing DEMO MODE label in the General Message area of the display. To exit Demo Mode and return to normal monitoring mode, turn the power off and back on.
- The NICO monitor contains no user serviceable parts. Refer servicing to qualified service personnel.
- Do not attach an SpO_2 sensor distal to a blood pressure cuff. Valid data cannot be processed when the cuff is inflated. Attach the sensor to the limb opposite to the site used for the blood pressure cuff.
- This product and its accessories which have patient contact are free of latex.
- The NICO monitor is Year 2000 compliant.
- Data Validity: Inaccurate SpO_2 and Pulse Rate values may be caused by;
  - Incorrect application or use of a sensor
  - Significant levels of dysfunctional hemoglobin; carboxyhemoglobin or methemoglobin
  - Significant levels of indocyanine green, methylene blue, or other intravascular dyes
  - Exposure to excessive illumination such as surgical lamps—especially ones with a xenon light source, or direct sunlight
  - Excessive patient movement
  - Venous pulsations
  - Electrosurgical interference
  - Use of an IABP.
- NICO measurements will occur provided the following conditions are met:
  - The NICO sensor is properly installed in the patient’s breathing circuit.
  - Valid flow and CO_2 signals are detected with no significant signal artifact.
  - VCO_2 is greater than 20 mL/min.
  - $ETCO_2$ is between 15 and 70 mmHg (2.0 - 9.0 kPa or %)
  - The tidal volume is greater than 200ml.
  - The respiratory rate is between 3 and 60 br/min.
  - The STOP/CONTINUE REBREATHING key is not illuminated.
  - NICO is not paused by the monitor for any other reason (displayed in the C.O. message area)
- When a new CAPNOSTAT CO_2 sensor is attached to the monitor, or is moved from one monitor to another, it must be adapter zeroed before use.
- After the life cycle of the equipment and accessories has been met, disposal should be accomplished following national/local requirements.
- There is no screen indication during monitoring, except on start-up (or when the **SET ALERTS** screen is displayed), as to when the NICO alert settings are off.

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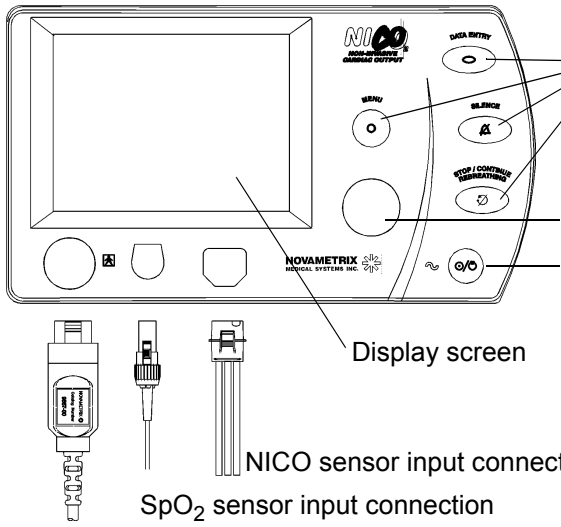
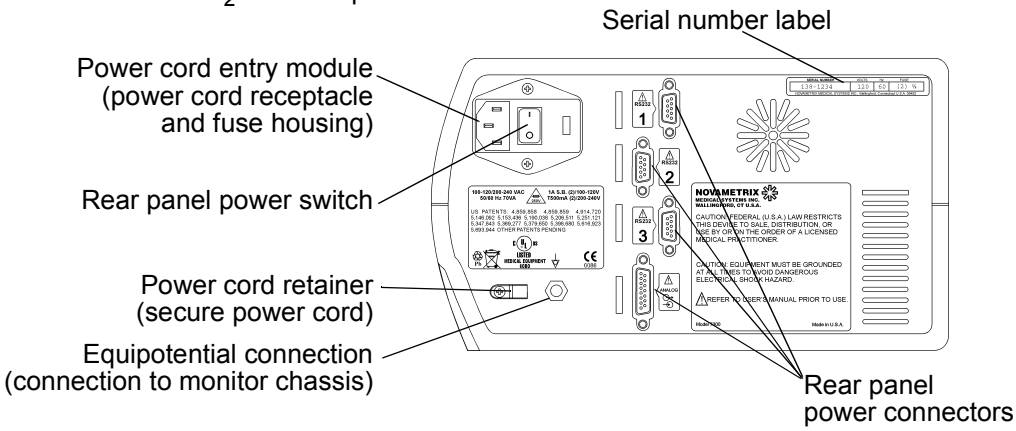
2 Introduction

2.1 About this manual

This document contains information which is proprietary and the property of Novametrix Medical Systems Inc., and may not be reproduced, stored in a retrieval system, translated, transcribed, or transmitted, in any form, or by any means, without the prior explicit written permission of Novametrix Medical Systems Inc. Novametrix reserves the right to change specifications without notice.

2.2 Front and Rear Illustrations





2.3 NICO Monitor Technical Description

Per requirements of IEC 601-1, the NICO monitor is classified as class II equipment, internally powered, with type BF applied part, and an enclosure protection rating of IPX0. The NICO monitor is Year 2000 compliant.

Transport/Storage: -10 to +55° C (14-131° F), 10-95% R.H. non-condensing
Operating Conditions: 10 to +40° C (50 to 104° F), 10-90% R.H. non-condensing

2.4 Manufacturing Quality & Safety

The Novametrix Medical Systems Inc. manufacturing facility is certified to both ISO 9001 and EN46001 (MDD93/42/EEC Annex II). Novametrix' products bear the "CE 0086" mark. The product is certified by Underwriter's Laboratories (UL) to bear the UL mark; and tested by TÜV Rheinland to IEC 601-1/EN60601-1.

2.5 Declaration of Conformity with European Union Directive

The Authorized Representative for Novametrix equipment is:

D.R.M. Green
European Compliance Services Limited,
Oakdene House,
Oak Road,
Watchfield
Swindon, Wilts SN6 8TD
United Kingdom

2.6 Trademarks and Patents

CAPNOSTAT CO_2 Sensor is a registered trademark (®) and NICO, $NICO_2$ and the stylized $NICO_2$ with CO2 shadow, NICO Sensor, NICO Loop and CObar (cardiac output confidence bar), SuperBright and Y-Sensor are trademarks (™) of Novametrix Medical Systems Inc. Other trademarks and registered trademarks are the property of their respective owners.

NICO and its sensors and accessories are covered by one or more of the following USA patents: 4,859,858, 4,859,859, 4,914,720, 5,146,092, 5,153,436, 5,190,038, 5,206,511, 5,251,121, 5,347,843, 5,369,277, 5,379,650, 5,398,680, 5,616,923, 5,693,944, 5,789,660. Other patents pending.

2.7 Manual Revision History

7-Aug-99	Release

3 Theory of Operation

3.1 NICO Model 7300 Non-Invasive Cardiac Output Monitor

The NICO model 7300 monitor measures cardiac output based on changes in respiratory CO_2 concentration caused by a brief period of rebreathing. The measurement of cardiac output is accomplished by interpreting data collected by proprietary sensors that measure flow, airway pressure, and CO_2 concentration, and then combining these signals to calculate CO_2 elimination. Using these variables, a technique known as Fick partial rebreathing is applied to calculate cardiac output. NICO can be used with mechanically ventilated patients in the operating room, intensive care, or emergency departments.

3.2 Digital Board 2763

3.2.1 Microprocessor

Refer to sheet 1 of the 2763-03 schematic.

The generation of the logic and control signals for the purpose of acquiring the raw physiological parameters, and management of the data needed to produce an accurate Non-Invasive Cardiac Output, are the responsibilities of microprocessor **IC1**. This device, a Motorola MC68332, is a highly integrated 32-bit microcontroller that combines high-performance data manipulation capabilities with powerful peripheral subsystems. These subsystems include circuitry for timing generation, peripheral chip selection and data control, interrupt generation, as well as synchronous and asynchronous serial communication. Also included is a sophisticated timing co-processor, the TPU (Time Processor Unit), that can generate complex timing waveforms independent of the main processor. In general, the signals for subsystems are functionally grouped into ports which can be independently programmed by software to be a pre-defined port function or discrete I/O. Additionally, the functionality for several ports (Ports C, E and F) can be pre-defined by the state of specific data bus lines on system power-up. Included is a special “background mode” port that allows the device to be externally controlled, facilitating system debugging and testing. Also integrated on-chip are several activity monitors as well as a software watchdog to ensure proper device and system operation. Refer to table 1.

Port	Defined Function	Functionality & Power-up Control
TPU 16 Channels	Timing Signal Generation	Each channel independently user programmable as TPU function or as Discrete I/O

Table 1: CPU Port Functions

QSM 4 Synchronous Serial Chip Selects & one asynchronous serial channel	Serial Communications Port: QSPI: Queued Serial Peripheral Interface SCI: Serial Communications Interface	QSPI chip selects independently user programmable, can be used as Discrete I/O or decoded to create up to 16 chip selects. SCI transmit can be programmed as Discrete I/O
Background Mode	System debugging	Allows an appropriate external device to control the microprocessor and system
C	Chip Selects	D0: CSBOOT* Data Width, 8 or 16-bit D1: CS1*-CS3* or BR*,BG*,BGACK* D2: CS3*-CS5* or FC0-FC2 D3-D7: CS6*-CS10* or A19-A23
E	Bus Control	D8: Control Signals or Discrete I/O
F	MODCK and Interrupts	D9: MODCK & IRQ or Discrete I/O

Table 1: CPU Port Functions

The operating frequency of the system clock in the *NICO* system is 24.117 MHz. It is generated by an internal VCO (Voltage Controlled Oscillator) derived from **Y1**, a 32.768KHz watch crystal, and is software programmable. The Timing Processor Unit (TPU) co-processor of the MC68332 provides complex timing functions generated from the system clock. This feature is utilized to control the precise timing required for the acquisition of the End Tidal Carbon Dioxide ($etCO_2$) and saturation (SpO_2) signals. The TPU is also used to generate the PWM (Pulse Width Modulation) control for the Capnostat Case and Detector heaters, and to provide the frequency generation for the audio tones. See Tables 2 and 3

Signal	Name	Function / Timing
CO2AZ	Auto Zero	Clears the Sample/Hold circuitry prior to data acquisition. Active High, 90 us
CO2PWENB	Pulse Width Enable	Defines the active time for both phases of the bipolar source pulse, used for pulse width protection circuitry. Active High, 810 us
SRCDRV0	Source Drive 0	First source drive signal. Active High, 405 us
CO2CSHL	Current Sample/Hold	Enables circuitry for source current measurement. Sample is taken when SRCDRV0 is active. Low = Sample, 90 us, High = Hold
SRCDRV1	Source Drive 1	Second source drive signal delayed for 10 microseconds after SRCDRV0 ends. Active High, 395 us
CO2SSH	Signal Sample/Hold	Enables circuitry for CO_2 and Reference channel data acquisition. Low = Sample, 90 us, High = Hold
CASEPWM	Case Heater PWM	PWM control for the case heater servo

Table 2: TPU Timing Generation for the $etCO_2$ subsystem

DETPWM	Detector Heater PWM	PWM control for the detector heater servo
TOUT1, TOUT2	Tone Generation	Variable frequency outputs to generate system audio

Table 2: TPU Timing Generation for the $etCO_2$ subsystem

Signal	Name	Function / Timing
ASAMPL	Auto Zero	Clears the Sample/Hold circuitry prior to data acquisition. Active Low
RDLEDL	Red Channel LED control pulse	Defines the active time for the Red LED. Active Low
IRLEDL	Infra-Red Channel LED control pulse	Defines the active time for the Infra-Red LED. Active Low
RSAMPL	Red Channel Sample/Hold	Enables circuitry for the Red Channel signal measurement. Sample is taken when SRCDRV0 is active. Low = Sample, 90 us, High = Hold
ISAMPL	Infra-Red Channel Sample/Hold	Enables circuitry for the InfraRed Channel signal measurement. Sample is taken when SRCDRV0 is active. Low = Sample, 90 us, High = Hold

Table 3: TPU Timing Generation for the SpO_2 subsystem

To help reduce and suppress the radiation of electromagnetic interference, ferrite filters (**L1-L11)** have been placed on clock signals with fast rise and fall times. Other digital signals, including address and data lines, are rise-time limited by the addition of small valued resistors and / or capacitors. In addition, good EMI/EMC design techniques have been incorporated in the component layout and printed circuit board manufacture.

Table 4 lists the chip select, control and discrete I/O functions for the *NICO* system module. On power-up, Ports E and F are programmed as discrete inputs by pulling down their controlling data lines, DB8 and DB9. After power-up, the software sets up each pin function individually and performs a series of self-tests to check the integrity of the system. During this period, the MPU holds the SYSUP line low which keeps the system in the initialization state. The state of configuration inputs on Port E (CNFG0, CNFG1 and CNFG2) and on data input buffer **IC10** (see sheet 2 on 2763-03 schematic) (JP1, JP2, JP2, JP4, TP4, TP5 and TP6) are read. These inputs allow the software to identify different operating conditions, such as Manufacturing Diagnostic Mode, or to recognize different hardware configurations. After the initialization period is complete and all system functions have been set, the MPU brings the status signal SYSUP high, indicating that the system is ready for patient monitoring operation.

Port	Pin Functions	System Signal Name[1]	I/O	Comments

Table 4: Chip Select, Control and Discrete I/O

C	DATA0 thru DATA7		O	D0-D7 pulled high, Pins are Chip Select on power-up
	CSBOOT*	ROMOEL	O	Program PROM Chip Select Word (16-bits) wide mode, D0 = HIGH
	CS0* / BR*	UBRAMWRL	O	Upper Byte SRAM Write Enable Allows for byte (8-bit) or word writes
	CS1*/ BG*	LBRAMWRL	O	Lower Byte SRAM Write Enable Allows for byte (8-bit) or word writes
	CS2* / BGACK*	SRAMOEL	O	SRAM Read Enable, Word
	CS3* / PC0 / FC0	ROMWRL	O	FLASH PROM Write Enable, Word
	CS4* / PC1 / FC1	UARTCSL	O	High Speed quad UART Chip Select
	CS5* / PC2 / FC2	BOOTWE	O	Port C Discrete Output, prevents unintentional writes to FLASH EPROM. This signal must be asserted before ROMWR* in order to overwrite the FLASH
	CS6* / PC3 / A19	A19	O	High Address line A19
	CS7* / PC4 / A20	RTCCSL	O	Real Time Clock Chip Select
	CS8* / PC5 / A21	DISPCSL	O	EL Display Chip Select
	CS9* / PC6 / A22	VRAMCSL	O	Video Memory Chip Select
	CS10* / ECLK / A23	CASCADEL	O	Cascaded Chip Select for Additional Parallel Peripherals
E	DATA8		O	D8 pulled low, Discrete I/O on power-up
	DSACK0* / PE0	CNFG2	I	Configuration Switch 2
	DSACK1* / PE1	DS1L	I	Data and Size Acknowledge 1*
	AVC* / PE2	CNFG0	I	Configuration Switch 0
	RMC* / PE3	CNFG1	I	Configuration Switch 1
	DS* / PE4	DSL	O	Data Strobe
	AS* / PE5	ASL	O	Address Strobe
	SIZ0* / PE6	SIZ0	O	Signifies current operation is 8-bit data
	SIZ1* / PE7	CNFG2	I	Configuration Switch 2
	R/W*	RDL	O	Data Read Strode
		WRL	O	Data Write Strobe

Table 4: Chip Select, Control and Discrete I/O

F	DATA9		O	D9 pulled low, Discrete I/O on power-up
	MODCLK / PF0	LED	O	LED CPU Activity Indicator
	IRQ1* / PF1	SYSUP	O	System Initialization Complete
	IRQ2* / PF2	CSOFTOT	O	Case Heater Over Temperature Shut Down
	IRQ3* / PF3	DSOFTOT	O	Detector Heater Over Temperature Shut Down
	IRQ4* / PF4	UARTIRQL	I	External UART Interrupt
	IRQ5* / PF5	EXTDCIN	I	Indicates external AC MAINS power operation
	IRQ6* / PF6	PWRDWN	O	System power down enable
	IRQ7* / PF7	NMIL	I	Non-Maskable Interrupt

Table 4: Chip Select, Control and Discrete I/O

1.Signal names with an “L” suffix are active low signals.

3.2.2 Background Mode Debugging and Application Development

Refer to sheet 1 on 2763-03 schematic.

Background debugging of the system during applications development or during system testing is possible by connecting an appropriate external device (emulator or debugger) to header **J1**. The signals present on this header enable an external device to halt the current microprocessor bus activity. This turns control of the microprocessor system over to the external device, placing the microcontroller into Background Debugging Mode. In this mode, the internal MPU registers can be viewed and altered, special test features can be invoked and the system’s memory, and peripherals can be read and written to.

Refer to sheet 2 on 2763-03 schematic.

In addition to the inherent debugging capabilities of the microprocessor, the digital board also contains circuitry to monitor events during application development. Output latches **IC15** and **IC17** along with Profiling header **J4** are used to determine CPU utilization during system development, latching various status bits out on the header.

3.2.3 System Memory

Refer to sheet 1 on 2763-03 schematic.

A 16-bit wide data path is used for FLASH PROM and SRAM transfers to maximize system throughput. Non-volatile memory, used for the storage of the boot-up and main program code, is contained in **IC4**, a 1024K x 8-bit, 5V FLASH ROM. To initiate the data transfer process, the MPU brings the ROMOEL output signal LOW, causing a word of program data stored in the FLASH ROM to be sent out on the data bus from the appropriate memory address. Program data may be updated by commanding the device to erase a block of its present programmed data then using the ROMWRL signal to place new program data into the address specified by the MPU. The FLASH ROM is internally protected from unintentional overwrites of the boot code by requiring an independent signal, BOOTWE, going active in addition to ROMWRL. The BOOTWE line must be high prior to writing new boot code into the FLASH device. Two 128K x 8-bit Static RAMs (**IC3 and IC6**) contain volatile data storage for use as a temporary data scratch pad during system operation and for recording patient trend information. To

retain patient trending data during periods of power down, the SRAMs are battery backed to retain their contents. A 2.5 Volt level VBACK generated from the main battery via IC30 on the 2764 Power Board, is supplied when the system is turned off and removed from the AC MAINS. During this battery backed-up state, transistor **Q1** keeps the chip enable control line of the SRAMs high and in a low power, inactive state. This forces the SRAMs data bus to a high impedance state, isolating the parts from the rest of the system. True non-volatile storage for system parameters is provided by a serial EEPROM (**IC8**), which has the ability to retain programmed information in the absence of power.

3.2.4 User Interface Control Circuitry

Refer to sheet 3 on 2763-03 schematic.

The user interface features a high contrast, 320 row by 240 column Electroluminescent Display module. Patient and system information is presented in both graphical and textual formats organized into several screen configurations. An integrated display controller, **IC19**, works in conjunction with the MC68332 MPU, and provides the necessary timing signal generation and housekeeping functions to display the visual information generated by the system. Programmable logic device **IC2** is designed to condition the logic signals between the MPU and display controller, making sure that the critical timing specifications of the two devices are met. SRAMS **IC18** and **IC22** provide video RAM storage for the display system. In addition to buffering the signals for the display interface, CPLD **IC2** also decodes chip selects for the system input buffers and output latches off of CASCADEL. If required, **IC2** can be reprogrammed in-circuit using header **J9**.

A 5-switch silicon keypanel and multifunctional rotary encoder provide operator control of screen selection, patient data entry, and user selectable input. The keypanel also contains several LEDs which represent various system conditions such as input power status (AC or Battery) and alarm state. Control of the user interface is generated from the CASCADEL chip select signal along with the appropriate address line state and WRL signals from the microprocessor. **IC10** and **IC13** (sheet 2 on schematic) are input buffers, which read in the present state of the keypanel and rotary encoder. Depressing a key or activation of the encoder causes the signal line associated to be pulled low, in contrast to its normally high state. Input buffer **IC14** provides a latched output for controlling the front panel LEDs as well as several other latched control outputs.

To supplement the visual indicators associated with the membrane keypanel and display, an audio output signal is generated to provide an additional mode to convey information to the user. The TPU processor of the MC68332 (TOUT1 and TOUT2) can generate two-tone frequencies. These signals are fed into separate reference inputs of the Quad 8-bit DAC, **IC20**, providing a means for independently attenuating each signal under CPU control. From the DAC, the individual signals are summed together by **IC21B** and filtered by **L11** and **C50**. Audio amplifier **IC23** drives the system speaker to produce system audio. Inverter **IC7F**, controlled by the SYSUP signal from the MPU, disables the audio amplifier until system initialization has been completed. DAC **IC23** also supplies an output voltage level SPO2VLED to set the current gain of the saturation drive circuit which is found on the *NICO* Power PCB, 2764-01. The circuitry associated with the DACB output (including **IC21A**, **Q3** and **J6**) is presently not used.

3.2.5 Real Time Clock, Power on RESET Generation and Glue Logic

Refer to sheet 2 on 2763-03 schematic.

Time keeping for date and time stamping of patient trend information is provided by Real Time Clock **IC16**. This device contains a built in crystal for precise time and date

measurement. The *NICO* system has been designed and tested for Y2K compliance. In the absence of digital power, the time keeping function is maintained by the battery backed-up supply, VBACK.

On power-up, the system is forced into a RESET state by **IC9** (sheet 1 on schematic). This chip creates the master active low system reset signal SRST*, holding up system initialization until a stable 5 VDC logic level is maintained. An inverter is used to generate RESET for devices that require an active high reset signal.

3.3 Power Supply 2764 (Power Supply and Communications)

3.3.1 Serial Communications UART

Refer to sheet 3 on 2764-03 schematic.

To enable serial communication with up to three external devices simultaneously, a Quad UART (Universal Asynchronous Receiver/Transmitter), **IC14**, is provided for buffered high-speed data communication. The connection to external, non-patient contact-type devices is electrically isolated from the patient applied sections by optical data couplers (**IC16, IC17, IC21, IC23, IC26**) and isolated winding off of the power supply flyback transformer, **T1**. Transceiver **IC13**, located on the patient-isolated circuit, provides signal translation between the system's TTL logic level and the RS-232 level requirements. Serial Ports A and C (**J1** and **J3**) are configured for a simple 3-wire (Transmit, Receive and Ground) connection, while Serial Port B (**J2**) has additional hardware handshaking capabilities. Connection to an external device is through a null-modem type of interface cable. The fourth UART channel is available on internal connector J5 for future product expansion. In addition, the system is capable of outputting four channels of analog output data through **IC22** and receiving four channels of analog input through buffer amplifiers **IC18** and A/D Converter **IC20** on connector **J4**. Voltage reference **IC19** supplies the analog I/O circuitry with a stable voltage level. Connector **J4** allows sensing of external cable connection by shorting pin 15 (IOSNSE) of the external cable to ground. Refer to Tables 5 to 8 for the pinout and signals of interface connectors.

J1		
Pin Number	**Signal**	**Function**
1	NC	No Connection
2	RxC	Serial Channel A Receive
3	TxC	Serial Channel A Transmit
4	NC	No Connection
5	Isolated Ground	Non-Patient Signal Ground
6	NC	No Connection
7	NC	No Connection
8	NC	No Connection
9	NC	No Connection

Table 5: Serial Channel A, 9-pin D-subminiature connector located on the rear panel

J2		
Pin Number	**Signal**	**Function**
1	NC	No Connection
2	RxB	Serial Channel B Receive
3	TxB	Serial Channel B Transmit
4	NC	No Connection
5	Isolated Ground	Non-Patient Signal Ground
6	NC	No Connection
7	RTSB	Request to Send Channel B, Hardware Handshake Output
8	CTSB	Clear to Send Channel C, Hardware Handshake Input
9	Isolated Power	Power

Table 6: Serial Channel B, 9-pin D-subminiature connector located on the rear panel

J3		
Pin Number	**Signal**	**Function**
1	NC	No Connection
2	RxA	Serial Channel C Receive
3	TxA	Serial Channel C Transmit
4	NC	No Connection
5	Isolated Ground	Non-Patient Signal Ground
6	NC	No Connection
7	NC	No Connection
8	NC	No Connection
9	NC	No Connection

Table 7: Serial Channel C, 9-pin D-subminiature connector located on the rear panel

J4		
Pin Number	**Signal**	**Function**
1	Isolated Ground	Non-Patient Signal Ground
2	ADCIN0	ADC Input Channel 0

Table 8: Analog Connector, 15-pin D-subminiature connector located on the rear panel

3	ADCIN1	ADC Input Channel 1
4	ADCIN2	ADC Input Channel 2
5	ADCIN3	ADC Input Channel 3
6	Isolated Ground	Non-Patient Signal Ground
7	Isolated Ground	Non-Patient Signal Ground
8	Isolated Ground	Non-Patient Signal Ground
9	Isolated Ground	Non-Patient Signal Ground
10	Isolated Ground	Non-Patient Signal Ground
11	DACOUT0	DAC Output Channel 0
12	DACOUT1	DAC Output Channel 1
13	DACOUT2	DAC Output Channel 2
14	DACOUT3	DAC Output Channel 3
15	IOSNSE	Cable connect sense input

Table 8: Analog Connector, 15-pin D-subminiature connector located on the rear panel

3.3.2 CO_2 Pulser Source Drive

The source drive circuitry is designed to drive the source with a bipolar signal to prevent the migration of charges within the source that may result from unidirectional electrical fields. The resistance of the source is monitored constantly to ensure the integrity of the system by sampling the current through the source while it is active.

Refer to sheet 1 on 2764-03 schematic.

The TPU co-processor in the MC68332 generates the timing signals that drive the power to the broadband infrared source located in the CAPNOSTAT CO_2 sensor. The SRCDRV0 and SRCDRV1 lines are used to control the direction of the current flow through the source. On the falling edge of CO2AZ (Auto Zero) and the rising edge of CO2PWENB (Pulse Width Enable), the SRCDRV0 signal goes High, enabling drivers **IC1A** and **IC2B** to turn on one half of the MOSFET H-Bridge formed by **Q1** and **Q2**. This causes current to flow through the P-Channel half of MOSFET **Q1**, through the CAPNOSTAT source, through the N-Channel half of MOSFET **Q2** and finally through **R23** to the negative supply rail, completing the first part of the Source Pulse cycle. The duration of SRCDRV0 is 405 us (microseconds). After the SRCDRV0 line goes Low, there is a 20 us software delay until the SCRDRV1 line goes High, enabling drivers **IC1B** and **IC2A** to turn on the other half of the MOSFET Bridge formed by the P-Channel half of **Q2** and the N-Channel half of **Q1**. This drives the current through the source in the opposite direction. The 20us software delay between the SRCDRV0 and SRCDRV1 signals is to prevent the possibility of both halves of the MOSFET bridge being active at the same time, thus creating a low impedance path between the two power supply rails.

When current flows through the source, it will also flow through current sensing resistor **R23**, creating a differential voltage proportional to the source current. This voltage is

measured during the last part of the SCRDRV0 period by differential amplifier **IC3A**, and is inputted to **IC9** (see sheet 2 on schematic), a 12-bit, 11-channel A/D Converter after being conditioned by the sample / hold circuit consisting of **IC4**, **IC5** and **C11**. The converter output of the sample / hold is processed in software to represent the current flowing through the CAPNOSTAT source:

$V_{SRC} = (V_{SR} / R_{SR}) * R_S * A_{V(DA)}$ where V_{SRC} = voltage out of difference amplifier proportional to current through the source element

= 24V +/- 0.625V

V_{SR} = differential voltage across the source element

R_{SR} = resistance of the source element

R_S = resistance of the current sensing resistor

= 1 ohm

$A_{V(DA)}$ = difference amplifier gain

= 5

V_{SRC} = [120 (Volts*Ohms) / R_{SR} (Ohms)]

For compatibility with present Novametrix monitors, the software displays the source current scaled by (1.1Vsrc) +17mV. In addition to monitoring the source current, the A/D Converter **IC9** also digitizes the feedback signals from the Saturation sensor and Power Supply.

In order to prevent the source from being driven until the system is up and ready, there is protection circuitry that inhibits the source drive until enabled. During system power-up, the RESET line keeps **Q3** on, preventing source pulses by pulling down SRCDRV0 and SCRDRV1 through **D3**. Protection circuitry also guards against extended pulse width as well as shortened duty cycle. On the rising edge of CO2PWENB, the trip point of **IC6B** is exceeded, bringing the output of **IC6B** high as **C12** charges through diode **D4**. This allows capacitor **C8** to charge up through **R22**. If the CO2PWENB signal does not turn the Source Pulser off within 200 us after the 810 us pulse period, the voltage across **C8** will exceed the trip point for **IC6A**, pulling the CO2INH line low and turning the Pulser off. After the CO2PWENB signal returns Low, capacitor **C12** is allowed to discharge through **R26**, keeping the output of comparator **IC6B** at the voltage acquired during the period when CO2PWENB was High. After approximately 7.2ms, **C12** will have discharged below comparator **IC6B**'s trip point. The comparator output goes low, discharging **C8** and the circuit is ready for the next source pulse cycle.

3.3.3 CAPNOSTAT Case and Detector Heater Control

Refer to sheet 2 on 2764-03 schematic.

The temperature of the CAPNOSTAT sensor system directly affects its ability to accurately measure CO_2. Two separate heaters and control circuits are used to maintain the sensor temperature at a precise value. One heater regulates the temperature of the detectors that detect the amount of infrared energy passing through the sample chamber; the other regulates the temperature of the transducer case (and loosely maintains the temperature of the airway adapter). While the purpose of the detector heater is to keep the detectors' sensitivity to infrared radiation constant, the function of the case heater is to keep condensation from forming on the airway windows by elevating the window temperature above the ambient airway temperature. Both heaters use an efficient Pulse-Width Modulation scheme designed to decrease power consumption, with the PWM timing generated by the TPU under microprocessor

control. The MPU senses the voltage output from the CAPNOSTAT case and detector thermistors (circuit described in the Analog 2754-01 PCB discussion) and regulates the output pulses from the TPU, creating a pulse duty cycle that is proportional to the amount of energy required to maintain the heater temperature. Dual MOSFET Driver **IC10** buffers the TPU signals to drive the gates of Dual P-Channel MOSFET **Q7**. These drive signals are AC coupled by capacitors **C24** & **C31** to ensure that if PWM pulses are lost for any reason, the MOSFET gates will be pulled up by resistors **R40** and **R47** which will turn the MOSFETs Off, removing power to the Capnostat heaters. Dual MOSFET **Q4** also controls power to the heaters, allowing independent over-temperature cut-off of each heater by both software and hardware watchdogs. **D6**, **L1** and **C25** help turn the pulses for the Case Heater from **Q7A** into a steady DC output, while **D8**, **L2** and **C32** smooth out the Detector Heater output from **Q7B**. Since the TPU-generated PWM signal is based on the system clock, it is synchronized with the generation of the source pulse timing. This minimizes the effect of any random disturbance caused by the heater circuit on the detection of the CO_2 Data and Reference signals.

3.3.4 Saturation LED Power Generation and LED Drive

Refer to sheet 2 on 2764-03 schematic.

Adjustable voltage regulator **IC11** is configured as a constant current supply for the Red and InfraRed (IR) saturation sensor LEDs. **R50** limits the current to Vref/R {1.25V/26.7 ohms} or 50mA, while Zener diode **D9** sets the maximum output voltage at 7.5 Volts. Capacitors **C36** and **C37** provide a reservoir for providing the instantaneous current demanded when the LEDs are turned on. Transistor **Q11** allows shutting down the power to the sensor LEDs by the microprocessor.

Connector **J4** on the *NICO* 2765-01 Analog Board connects the saturation sensor to the monitor. Both of the saturation sensor LEDs are controlled by an amplifier configured as a constant current driver. The voltage control for the constant current drive, SPO2VLED, comes from DAC **IC20** on the *NICO* Digital Board, 2763-01. The cathode of the Red LED channel is tied to the driver consisting of amplifier **IC12A**, MOSFET **Q10** and resistor **R57**. Since the amplifier is connected as a non-inverting amplifier, the voltage appearing at the positive terminal will also appear at the negative terminal and across **R57**. This voltage, nominally 0.74V, creates a current through **R50** of 225mA {0.74V/3.3 ohms} when the RDLED* signal is asserted which also flows through the Red LED of the Saturation sensor via **Q10**. The driver for the IR LED (**IC12B**, **Q13** and **R64**) creates a constant current source of 111mA across **R64** and is controlled by asserting the IRLED* signal. The two control signals operate at 33 kHz with a 10% duty cycle and are staggered so that one LED is on during the middle of the other LED's off time.

3.3.5 Power Supply and Voltage Reference Generation

The monitor operates either on isolated AC Mains power or on the internal 12-Volt Lead-Acid Battery. To provide isolation from the MAINS lines as well as AC/DC voltage conversion, the *NICO* monitor utilizes a Medical Grade, universal input off-line switching power supply. The DC output of this supply is 15 VDC at 40 Watts, and is brought to the Power board on connector **J6** (sheet 5 on schematic). The heart of the power supply design for the system is a 100 kHz switching regulator, **IC34** (sheet 4 on schematic), which utilizes a flyback transformer configuration to generate the DC supply voltages and provide the required isolation between the primary, secondary and isolated power planes. Power On / Off control is achieved by sensing the state of the power switch located on the front panel. A high to low transition on the PWRSW line is debounced by **C85** and **IC31A**, and clocked into Flip-flop **IC32A**, which causes the Flip-

flop output to toggle its present state. A high output causes switching regulator **IC34** to be turned on, supplying power to the system. Flip-flop **IC32B** provides control over the state of the system when the user turns the system “Off”. When the monitor is operated from an AC MAINS power source the green AC ON indicator on the front panel is lit. If the monitor is on, pressing the power key on the front membrane keypanel will not power the monitor down. Instead, the monitor is placed in a standby operating mode. The display and other non-essential control functions are inactivated by the software, giving the monitor the appearance of power down. While in standby, however, the core system continues to operate, keeping the Capnostat heaters within temperature regulation. This reduces the time required to bring the system up to full operating specifications during the following power-up cycle. While on battery operation, depressing the Power Key on the front keypanel will turn off the switching regulator, thus powering down the system. Stand by mode is disabled and power to the system is turned off. The monitor enters a low power mode where only circuitry required for SRAM and real-time clock battery back-up and Power Key sensing is kept supplied. Power for the SRAM and Real-time clock, VBACK, is determined by the state of VDD. When VDD is available and transistor **Q23** is turned on, VDD is supplied through transistor **Q21**. In the absence of VDD, VBACK drops down to a low power level supplied through diode **D36**.

During system initialization, the switching frequency is synchronized to the main system clock by the components associated with **Q17** to reduce system data acquisition errors due to power supply interference. The nominal synchronized frequency is 156 kHz. The primary of transformer **T1** is designed to accept 10 to 24 V DC input and provides secondary outputs of nominally 5 VDC, +14 VDC, and -14 VDC. An additional winding pair is isolated by 2KV from the other transformer windings to provides 9VDC output for the earth connected and patient isolated serial and analog input and output circuitry. The 5VDC supply (VDD) provides feedback to the switching regulator by resistor divider **R108** and **R112**. The other windings are loosely regulated by the requirements of the 5 VDC supply by the ratio of the transformer windings, creating semi-regulated secondary voltages for the analog supplies of approximately +\-14VDC. The 5V supply is L-C filtered to provide clean logic supplies for both the digital logic (VDD) and the analog sections of the Digital and Power Boards (DVDD). Another filter isolates the 5-Volt supply for the Flow Pneumatics (VVDD) from the rest of the system. Regulators **IC33** and **IC36** are designed as a tracking regulator pair to provide a 24VDC differential voltage for powering the Capnostat source (+VSRC, -VSRC). The voltage level of the +VA supply is monitored by **IC35B** to ensure that a tight voltage range is maintained and not exceeded in the event that the +5 VDC feedback to the switching regulator, **IC34**, is lost. Linear regulator **IC27** provides the logic and analog supply for the patient-isolated circuits.

Power for the CAPNOSTAT heaters and the display are derived off of the main 15 Volt input from the offline switching regulator during connection to an AC MAINS power source. During AC operation, the signal LINEST is High, indicating the presence of AC MAINS. **IC37**, also a switching voltage regulator, and its associated circuitry provide these functions with a well-regulated 12 VDC supply. When the monitor is operating off of the internal battery, LINEST is Low, disabling the switching regulator and turning on MOSFET **Q19A** which is controlled by voltage comparator **IC35C**. In this mode, the heaters and display are supplied directly with battery power, minimizing power losses that occur during the conversion of one voltage level to another. The output from comparator **IC35C** also controls the Reset input to Flip-flop **IC32B**, determining whether the monitor is in AC stand-by or DC Power Down operating mode.

Charging the battery takes place as long as the unit is connected into a viable source of AC MAINS power and the power entry module switch is in the “On” position. In order

to charge the battery as quickly and efficiently as possible, a two-step charging process is employed. Assuming the battery is in a depleted charge state, feedback to the low drop-out linear regulator, **IC39**, sets the voltage output at a fast-charge level of approximately 14 VDC. Sensing the voltage drop across **R144**, comparator **IC40A** monitors the current draw of the battery, limiting it to approximately 250mA for a maximum charge rate of C/10. If the battery tries to draw current in excess of the amount allowed, **IC40A** turns off the regulator, thus limiting the charging current. As the battery reaches a fully charged state and the current draw decreases to approximately 50mA, **IC40B** turns transistor **Q27** off which causes the regulator to change its output to a float charge voltage of approximately 13.2 VDC, which maintains the battery in a constant state of readiness.

If AC power is lost or is not available, the monitor automatically operates from its internal battery without interruption. The AC ON indicator is extinguished and a BATTERY ICON appears on the display, indicating the current power level of the battery. While on internal DC power, the current state of the battery is monitored by both software and hardware (**IC29**, **IC28A** and **IC35A**). Should the battery power level get critically low, the monitor software, which monitors the VBATTADC signal into A/D Converter **IC9** (sheet 2 on schematic), alerts the user. If the monitor is not placed on AC MAINS power within approximately ten minutes, the software will turn the unit off. Should the software fail to turn the monitor off, the hardware cutoff, controlled by comparator **IC35A**, activates, turning the unit off.

Stable reference voltages for the analog circuitry are derived from **IC7** (sheet 1 on schematic), a precision 2.5V with low drift. Five Volt and 2.5 Volt references are generated by **IC8**.

Refer to Table 9.

Signal	Supply	Description
VDCIN	+10 - +15 VDC	Main DC input generated from offline switcher or internal battery
VBATT	+10 - +12.5VDC	Internal Battery DC input
VBACK	+2.5VDC or +5VDC	Supply for SRAMs, either VDD or 2.5V to maintain SRAM data during power down
VHTR	+12V or VBATT	Supply for the Capnostat Case and Detector heaters and Fan, regulated at 12V when MAINS power available or from VBATT when unit is on battery power
DISPVA	+12V or VBATT	Supply for the EL Display, regulated at 12V when MAINS power available or from VBATT when unit is on battery power
VDD	+5VDC	Regulated digital logic supply
VVDD	+5VDC	Regulated and filtered supply for the valves
CVDD	+5VDC	Regulated and filtered logic supply for CO_2 analog sub-system
DVDD	+5VDC	Regulated and filtered logic supply for general analog sub-systems
ADCVDD	+2.14VDC	ADC input for monitoring VDD
+VA	+14VDC (nominal)	Loosely regulated off of the 5VDC feedback line

Table 9: Power Supply Outputs

+VSRC	+12VDC	Linearly Regulated and filtered positive supply for the Capnostat Source. Tracks -VSRC to provide a 24V +/- 2.5% differential voltage across the source
ADCPVSRC	+0.85VDC	ADC input for monitoring +VSRC
-VSRC	-12VDC	Linearly Regulated and filtered negative supply for the Capnostat Source. Tracked by +VSRC to provide a 24V +/- 2.5% differential voltage across the source
ADCNVSRC	+0.75VDC	ADC input for monitoring -VSRC
-VA	-14VDC (nominal)	Loosely regulated off of the 5VDC feedback line
IRAW	+7.5VDC (nominal)	Loosely regulated off of the 5VDC feedback line, isolated from the other transformer windings
IVDD	+5VDC	Linearly Regulated to provide an isolated digital and analog power source

Table 9: Power Supply Outputs

3.3.6 Logic and Input / Output Signal Control

Refer to sheet 6 on 2764-03 schematic.

Chip selection for the serial peripherals are provided by decoders **IC43** and **IC46** and by the inverters **IC47**, **IC45E** and **IC45F**. Latch **IC41** is used mainly to control the system pneumatics, with Latch **IC42** providing additional control signals for the *NICO* 2765-01 Analog Board. Input buffer **IC44** allows the digital system to read various status signals from the Analog Board.

3.4 Analog Board 2765-01

3.4.1 CAPNOSTAT Interface

Refer to sheet 1 on 2765-03 schematic.

A twenty pin connector, **J2**, interfaces the CAPNOSTAT with the system electronics. Ferrite filters have been placed on all lines to suppress radiated EMI and reduce susceptibility from high frequency external sources of interference.

Stable reference voltages for the sensors and analog circuitry are derived from **IC1**, a precision 2.5V reference with low drift. Five Volt and 2.5 Volt references for the CO_2 and Saturation circuits are generated by **IC2**. Positive and negative supply rails for the analog circuitry are derived from linear regulators **IC6**, **IC7** and **IC50**, while regulators **IC3** and **IC49** and provide regulated voltage supplies for the CAPNOSTAT itself.

3.4.2 CO_2 Input Signal Path

Refer to sheet 2 on 2765-03 schematic.

The signals from the sensor CO2DATAIN (CO_2 Data) and CO2REFIN (Reference Signal) have similar signal paths. The CO2DATAIN passes through a high pass filter with a gain of 7.65 consisting of **C60**, **R68** and buffer amplifier **IC15B**. The signal is fed to a Butterworth low pass filter **IC15A** and associated components. This filter has a gain of 2 with a corner frequency of 1.5 kHz. The output from the low pass filter is fed to a 12-bit Digital to Analog converter **IC14**. The signal, CO2DFB comes into the feedback pin of the DAC, which acts as a programmable gain stage. Here, under

processor control, the signal's gain is adjusted to an acceptable level for conversion. The gain setting is adjusted using the digitized signal out of A/D Converter **IC4** (sheet 1 on schematic) as part of the feedback loop. Similarly, CO2REFIN is conditioned by high pass filter **IC16B** with a gain of 3.5 and low pass filter **IC16A** with a gain of 2. The equivalent fixed gains for the two input signals are not equal in order to compensate for differences in the output signal levels of the infra-red detectors in the CAPNOSTAT.

The output from DAC **IC14** corresponding to signal CO2DATAIN is buffered by **IC12A** and AC coupled through **C49** to **IC11A**. The CO2DATA signal received from the CAPNOSTAT is AC coupled prior to the high pass filter to remove any DC bias by **C60**. Prior to sampling a CO_2 signal, the CO2AZ (Auto Zero) pulse turns **Q1** on causing any residual charge on **C49** to discharge to ground. At the start of the source pulse, the CO2AZ pulse goes Low and the CO_2 signal from the sensor is acquired. The signal is buffered by **IC11A** before appearing at the input of the sample and hold amplifier, **IC13A**. Near the end of the source pulse, the CO2SSH (CO_2 Sample and Hold) goes Low and the peak signal is acquired on the internal sample and hold capacitor. CO2SSH returns high at the end of the cycle, and the CO_2 signal on the sample capacitor is held at the peak value. The signal then passes through a low pass filter and resistive divider network consisting of **R51**, **R53** and **C51** before being converted by the A/D Converter **IC4** into digital data and analyzed by the processor. The signal CO2REF follows an identical zeroing and acquisition path.

3.4.3 *CO_2 Case and Detector Heater Regulation*

Refer to sheet 2 on 2765-03 schematic.

For the purpose of describing the regulation loop, the case heater circuitry will be considered. The detector and case heater circuitry are identical.

Inside the CAPNOSTAT, a sensing thermistor is thermally connected to the heater module. Initially, the CAPNOSTAT is at ambient temperature and the resistance of the thermistor is large. A small current flows through the signal path CASETHERM and only a small voltage is developed across **R47**. The microprocessor programs the TPU to allow an initial maximum duty cycle of 70% to power the PWM heater circuitry. This causes the heater control MOSFET on the *NICO* 2764-01 Power Board to be pulsed on and off with a duty cycle that is under direct control of the program software. As the heater warms up the case, the thermistor's resistance decreases, raising the voltage appearing at the input of the control loop. As described below, the MPU looks at this output voltage and decreases the duty cycle of the PWM control circuitry, gradually reducing the power output into the heater. When the desired temperature set point is reached, a balance is struck between the energy delivered into the system and the heat flow out of the system.

The case thermistor is sensed by amplifier **IC9B**. The difference between the signal at the non-inverting input and the reference appearing at the inverting terminal generates an error voltage proportional to the sensed temperature at the amplifier's output:

e_o (V) = [83.133V / (R_{th}+3.32K)] - 10.2V where e_o = amplifier output voltage

R_{th} = resistance of the thermistor

= 4.36933K at 45°C

Temp (°C) = 4.1288 (°C/V) * $e_{o\,(T)}$ V + 41.7321°C

where e_o = amplifier output voltage at temperature T

This error voltage is low pass filtered by amplifier **IC8B**, sent to the ADC and processed by the CPU to regulate the output pulses from the TPU. The error voltage out of amplifier **IC9B** also appears at the temperature watchdog comparator **IC10A**. If the

error voltage reaches approximately 56 degrees Celsius, the comparator trips, causing the output to go Low and turning off the heater supply on the Power Board.

3.4.4 Flow Zeroing and Patient Line Purging

Refer to sheet 5 on 2765-03 schematic.

The zero process begins when the CPU brings the VALVE1, VALVE2, VALVE3 VALVE4and VALVE6 lines high, energizing valves **V1**, **V2**, **V3, V4** and **V6**. This action disconnects the differential pressure transducer **IC18** (via **V1** and **V2)** and the absolute pressure transducer **IC29** (via **V2**) from the patient airway, shunts the differential pressure sensor ports (**V4**), and opens all pressure transducer ports to atmosphere through **V3**. Valve **V6** switches the pump output from the external *NICO* Valve to the internal patient tubing and flow sensor. The differential pressure transducer is “zeroed” by capturing the digital output of the 20-bit sigma delta A/D Converter, **IC25** (sheet 3 on schematic), during this zero flow condition, and using this value to set the software. The patient airway pressure transducer is "zeroed" by adjusting the output of the DAC, **IC26** pin 10 (sheet 3 on schematic), until the Airway Pressure signal into the ADC, **IC4**, reads mid-scale. The barometric (ambient) pressure, as sensed by **IC28** (sheet 3 on schematic), is recorded after the airway pressure zero is completed. IC30 acts to filter the signals from the barometric pressure and airway pressure channels. After the result from each channel is stored in SRAM to be used as an offset in the flow and pressure calculations, valves **V1**, **V2**, **V3, V4** and **V6** are then de-energized, reconnecting the pressure transducers with the patient airway.

If patient line purging is enabled by the software, the system turns on the pump by bringing the PURGE line high after the zero values are recorded. A slight pressure is allowed to build in the pump tubing line that will aid in flushing out the patient airway tubing. To purge patient line 1, the CPU brings the VALVE1 and VALVE4 signals high, energizing Valves **V1** and **V4**. **V1** connects the pump with the P1 patient line, flushing out the patient P1 line while **V4** shunts across the differential pressure transducer, preventing a differential pressure from appearing across the transducer. During purging, the system is able to monitor the pressure that is present in the selected patient line by reading the AWPRESS signal. VALVE1 is brought low and **V1** is the de-energized, once again isolating the pump from the patient airway and allowing a pressure head to build once more. The VALVE2 line is then brought high and valve **V2** is then energized, flushing out the patient P2 line. After all lines have been flushed out, **V1** and **V3** are re-engerized allowing any residual pressure to be vented to atmosphere. All valves are then de-engerized and the PURGE signal is brought low, turning the pump off. The purging process is complete and normal patient monitoring continues.

A hardware watchdog, consisting of **IC44A** and the surrounding circuitry, limits the maximum pump-on time, preventing overpressure from building in the patient lines.

3.4.5 Flow Circuitry

Refer to sheet 3 on 2765-03 schematic.

Differential Pressure Transducer, **IC18**, is a silicon based, piezoresistive bridge with four active elements. When a pressure is applied between transducer ports P1 and P2, a differential output voltage proportional to the applied pressure is produced. The full-scale output range for the transducer is 0 to 10 inches of water (P1>P2). By setting the 0 differential pressure (no-flow) point to mid-scale (during the zeroing process described earlier), negative pressure readings (P2>P1) are also available. The transducer is temperature compensated at 25 degrees Celsius and designed to be driven by a constant voltage source.

In the normal system operating mode, all valves are de-engerized and the pump is inactive. Transducer ports P1 and P2 are connected to the patient airway. As air flows through the airway adapter pneumotach, a pressure difference between P1 and P2 is created. This signal is dependent on both the magnitude and the direction of the airflow. The greater the flow volume, the larger the pressure difference created between the two transducer ports. The transducer senses an inspired flow as a positive pressure difference (P1>P2), while an expiratory flow is seen as a negative pressure (P2>P1). With a supply voltage of 2.5V, the sensor transforms this pressure difference into an electrical signal with a nominal absolute magnitude of 23 mV Full-scale Output. This signal is conditioned and amplified by **IC23**, which is a monolithic Instrumentation Amplifier (IA). A positive pressure difference (inspiratory flow) creates a signal above the no-flow zero baseline obtained during the zeroing process. A negative pressure difference (expiratory flow) is below the set baseline. The nominal gain of **IC23** is set by fixed resistors **R85**, **R83** and variable resistor **VR1**. The output for the transducer is adjusted using **VR1** and a known pressure input as a calibration reference. With an input differential pressure of 20 cmH_2O, the gain of the amplifier is set to give an ADC count of 412160.

The signal out of the flow IA is taken through a two-pole low pass filter **IC22A** with a 31 Hz cutoff frequency to remove unwanted high frequency electronic noise. It is then passed on to the 20-bit sigma delta ADC, where it is transformed from an analog voltage into a digital code for processing by the CPU, located on the 2763-01 Digital Board.

3.4.6 Barometric and Airway Pressure

Refer to sheet 3 on 2765-03 schematic.

IC29 is a piezoresistive differential pressure transducer with port P2 held at zero psi. It measures the absolute pressure difference at port P1 relative to the vacuum at port P2. The transducer is calibrated for a full scale output of 0 to 15 psi, has internal temperature compensation, and is designed to be driven by a constant voltage source. Instrumentation amplifier (IA) **IC28** conditions this signal to correspond to the current barometric pressure, which is set by adjusting **VR3**. The nominal gain of this amplifier is 67, which corresponds to a 12-bit ADC count of 4012 at 760 mmHg. The output signal from **IC28** is low pass filtered by **IC30B** and appears as an input to both the 12-bit ADC and a second IA, **IC27**. **IC27** provides gain adjustment via **VR2** and offsets the output signal from the barometric amplifier to mid-scale during the zeroing state. The nominal gain of the airway pressure amplifier is 5. This signal connects to the P1 (proximal to the patient) side of the differential pressure transducer during monitoring and provides patient airway pressure sensing.

3.4.7 Patient Airway Adapter Type Sensing

Refer to sheet 5 on 2765-03 schematic.

Given a specific flow sensor type (i.e., Adult), the physical characteristics of the sensor will be consistent from one adapter to another. However, due to the differences in the physical size and geometry of the various flow sensor types, each type (i.e., Adult, Adult Combo) requires different coefficients be used in the calculation of flow. Each flow sensor type has a unique 4-bit code associated with it. This pattern molded into the connector body can be optically reflective or non-reflective and is read by the system. A pulse is generated by the CPU that turns on the LED component of a opto-coupler mounted directly beneath each pattern segment. If the pattern segment associated with that opto-coupler is reflective, the LED's light will cause its photodetector mate to be turned on, which generates a signal that is sensed by the system and relayed back to the CPU. If the segment is non-reflective, no signal is returned to the sensing circuitry.

A four-bit code can generate 16 unique pattern combinations. One code condition, all zeros (no reflection), is reserved for detecting when the sensor unplugged. The circuitry to decode the flow sensor type consists chiefly of connector J5 and comparator IC40.

3.4.8 NICO Sensor Rebreathing Valve Control

Refer to sheets 3 and 5 on 2765-03 schematic.

To initiate a *NICO* cycle and switch the external *NICO* Valve from non-rebreathing to rebreathing mode, valve **V5** is energized, which switches the tubing to the external valve from atmosphere to the pump. The pump is turned on, causing the diaphragm in the *NICO* valve to switch to rebreathing mode. The pressure in the airline is monitored by pressure transducer **IC32** and IA **IC31**. When adequate pressure to switch the valve is reached, the pump turns off and the software continues to monitor the airline pressure to ensure pressure is maintained. Valve **V6** has a time-out watchdog, **IC44B**, to ensure that software control over the external *NICO* valve is maintained.

3.4.9 Saturation Input Signal Path and Signal Conversion

Refer to sheet 4 on 2765-03 schematic.

On power up, the system performs a self-calibration cycle to establish the level of background circuit offset. Calibration is performed by coordinating the control signals SPO2CAL, SPO2SC1, ASAMPL, RSAMPL, ISAMPL, SIGNDL and INSIGL. Once the system baseline has been acquired, the Red and Infrared ADCs, **IC33** and **IC37**, adjust their output to compensate for any system offsets found. Since the LED drives are staggered, a single detector is used to multiplex the individual signals on a common signal input line. Amplifier **IC36B** performs a current to voltage conversion on the input signal, and analog switch **IC35** steers the signal to the proper 20-bit ADC based upon the LED channel (Red or Infrared) that is currently active. A sample and hold circuit for each channel made up of **IC35** and **IC34** transform the pulsed input signal into a constant voltage level for signal conversion. The main timing signal generation for saturation signal acquisition is generated by the TPU. Amplifier **IC38A** generates an analog signal, SPO2PROB, that varies with the saturation probe type. SPO2PROB is converted to digital form by ADC **IC9** on the *NICO* 2763-01 Digital Board Schematic.

4 Functional Testing

The functional Testing verifies overall functional integrity of the monitor and sensor. If the Model 7300 does not pass these tests, remove from use and contact the Novametrix Service Department for repair/replacement assistance. Refer to the Accuracy Tests for testing the rear panel connectors.

This procedure assumes the technician performs each step as indicated - leaving the monitor in a known state prior to performing the next step. If steps are omitted or performed out of order, be sure that the monitor is set to the correct state before continuing.

4.1 Equipment Required

1. CAPNOSTAT CO_2 Sensor, PN: 9567-00
2. NICO sensor, PN: 8951-01
3. SpO_2 Finger Sensor, PN: 8776-00
4. 500ml Calibration syringe, Hans Rudolph Model 5550 or equivalent
5. Model 1298 Gas Calibrator, PN: 6081-00
   Low point calibration gas, PN: 8364
   Adult airway adapter PN: 7007-01 Qty. 3

4.2 Functional Test

In this procedure the term “select” refers to highlighting a selection on the screen by turning the knob, then pressing it in to select the highlighted option.

1. Connect the monitor to the AC line. Set the rear panel power entry module switch ON. Verify the AC LED turns on.
2. Press the power switch. Verify the display shows the NICO start up routine followed by the main display screen (reference the Users Manual for display appearance).
3. Connect the NICO sensor to the monitor. Verify an ADULT NICO ADAPTER IDENTIFIED message is momentarily displayed.
4. Connect the CAPNOSTAT CO_2 sensor to the monitor. Verify the CO_2 SENSOR? message is replaced by a WARMUP message.
5. Place the CAPNOSTAT CO_2 sensor on the NICO sensor airway adapter.
6. Press the MENU button. Verify the SELECT A SCREEN menu is displayed.
7. Select the SETUP screen.
8. Select CO_2 ZERO NOW. Follow the screen prompts to perform a zero calibration. When the zero calibration is complete, select EXIT.

NOTE: The CAPNOSTAT CO_2 sensor must reach operating temperature before zeroing.

9. Connect the low point calibration gas to the Model 1298 Gas Calibrator. Refer to the instructions supplied with the gas calibrator for further instructions.
10. Connect the Model 1298 Gas Calibrator with low point calibration gas to the NICO sensor via the airway adapter stack (see instructions with Model 1298 Gas Calibrator).
11. Press and hold the MENU and DATA ENTRY keys simultaneously until the CONFIGURATION MENU appears. Select DIAGNOSTIC SCREENS, then select CO_2.
12. Flow gas for thirty seconds. Verify the CO_2 value is 41 ± 2.
13. Turn the calibration gas off. Select EXIT and remove the Model 1298 Gas Calibrator.
14. Select CO_2/SpO_2.
15. Breathe into the NICO sensor, verify both $ETCO_2$ and RR values.
16. Stop breathing into the NICO sensor. Wait for 20 seconds, verify that an alert is generated and NO RESP: X:XX is displayed where X:XX starts at 0:20 and counts up in seconds. Press SILENCE to reset any audible alerts.
17. Turn the knob until the FLOW/PAW screen is displayed.
18. Connect the 500 ml calibration syringe to the NICO sensor. Pump the syringe back and forth at a rate of 15 cycles per minute. Verify a Vti and Vte of 500ml ± 25.
19. Remove the calibration syringe.
20. Press the MENU button. Select SET ALERTS. Verify the SET ALERTS screen is displayed.
21. Select the low pulse (bpm) alert. Verify the ENTER LOW PULSE LIMIT screen is displayed.
22. Record the current value of the low pulse limit. Follow the screen instructions and set the low pulse limit to 99. Verify that the bell icon next to the limit is active (does not have a line through it). If not select it to enable audible alerts.
23. Select the AUDIO. Follow the screen instructions and scroll through the audio levels. Verify the audio increments with each audio level. Set the audio level to 5.
24. EXIT the SET ALERTS screen.
25. Turn the knob until the CO_2/PLETH screen is displayed.
26. Connect the finger sensor to the monitor. Verify the SPO_2 PROBE? message is replaced by a PULSE SEARCH message.
27. Place the SpO_2 finger sensor on your finger. Verify an SpO_2, pulse rate and pleth waveform are present. Verify the pulse value is blinking, LOW PULSE is displayed, and an audio alert is heard.
    Note:If your pulse is not below 99 you will not get the error.
28. Press the SILENCE button. Verify the audio alert is silenced and the SILENCE button is flashing between yellow and red.
29. Remove the finger sensor from your finger. Verify a PULSE SEARCH message is displayed.
30. Follow steps 20. 21. and 22. to return the low pulse limit to the previous value.

31. Press the MENU button, select SETUP. Verify the SETUP screen is displayed.
32. Select SET TIME & DATE. Verify the time and date are correct.
33. Exit the SET TIME & DATE screen then EXIT the SETUP screen.
34. Set the power entry module switch on the rear panel to the OFF position. Verify the AC indicator turns off, a battery icon is displayed and the monitor continues to operate. Set the power entry module switch back ON.
35. The test is complete. Disconnect the sensors from the monitor and turn it off.

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5 Accuracy Tests

The Accuracy Tests verifies the performance accuracy of the Model 7300. This test is typically performed in conjunction with (after) the Functional Tests. If the monitor does not pass the Accuracy Tests, remove from use and contact the Novametrix Service Department for repair/replacement assistance.

This procedure assumes the technician performs each step as indicated - leaving the monitor in a known state prior to performing the next step. If steps are omitted or performed out of order, be sure that the monitor is set to the correct state before continuing.

5.1 Equipment Required

1. Leak test adapter, PN: 9695-48
2. Calibrated barometer
3. Capnostat CO_2 Sensor, PN: 9567-00
4. Model 1298 Gas Calibrator Catalog No. 6081-00
   Low point calibration gas, Catalog No. 8364
   Adult airway adapter PN: 7007-01 Qty. 3
5. TB500B Saturation simulator, PN: 5530-00
   This is the same device used by the factory technicians to calibrate the monitor prior to shipping. The TB500B is an updated version of the TB500A Test Box. The TB500A, used in conjunction with adapter cable (Cat. No. 5453-00), may be substituted for the TB500B in most parts of this test.
6. SpO_2 Finger Sensor, PN: 8776-00
7. NICO sensor, PN: 8951-01
8. 500ml Calibration syringe, Hans Rudolph Model 5550 or equivalent

5.2 CO_2 Testing

In this procedure the term “select” refers to highlighting a selection on the screen by turning the knob, then pressing it in to select the highlighted option.

1. Connect the monitor to the AC line. Set the rear panel power entry module switch ON. Verify the AC LED turns on.
2. Press the power switch. Verify the display shows the NICO start up routine followed by the main display screen (reference the Users Manual for display appearance).
3. Connect the NICO sensor to the monitor. Verify an ADULT NICO ADAPTER IDENTIFIED message is momentarily displayed.

4. Connect the CAPNOSTAT CO_2 sensor to the monitor. Verify the CO_2 SENSOR? message is replaced by a WARMUP message.
5. Place the CAPNOSTAT CO_2 sensor on the NICO sensor airway adapter.
6. Press the MENU button. Verify the SELECT A SCREEN menu is displayed.
7. Select the SETUP screen.
8. Select CO_2 ZERO NOW. Follow the screen prompts to perform a zero calibration. When the zero calibration is complete, select EXIT.
   NOTE: The CAPNOSTAT CO_2 sensor must reach operating temperature before zeroing.
9. Connect the Model 1298 Gas Calibrator with low point calibration gas to the NICO sensor via the airway adapter stack (see instructions with Model 1298 Gas Calibrator).
10. Press and hold the MENU and DATA ENTRY keys simultaneously until the CONFIGURATION MENU appears. Select DIAGNOSTIC SCREENS, then select CO2.
11. Flow gas for thirty seconds. Verify a CO_2 reading of 41 ± 2.
12. Shut the gas flow off. Remove the Model 1298 Gas Calibrator.
13. Verify the following displayed parameters:

SRC CUR	180-300
DET T	45.00 ± 0.2
CASE T	45.00 ± 0.2
DATA CHAN	3400 ± 200
REF CHAN	3400 ± 200

5.3 SpO_2 Testing

14. Select SPO_2 from the CO2 DIAGNOSTIC SCREEN.
15. Verify the STATUS: is “9 Probe Xconnect”.
16. Set the controls on the TB500B as follows:
    SENSOR TYPE: 87XX
    SIGNAL ATTENUATION:3
    SATURATION SETTING:100
    POWER:ON
17. Connect the TB500B to the monitor.
18. Set the saturation switch on the TB500B to “0”. Verify the status is “2 Low Signal”.
19. Set the saturation switch on the TB500B to “100”. Verify the status returns to “0”.
20. Turn the TB500B OFF. Verify the status line reads “3 Low Light”.
21. Turn the TB500B ON. Verify the status returns to “0”.
22. Press and hold the RED open test button on the TB500B. Verify the status is “13 IR LED FAIL”.
23. Release the RED open test button. Verify the status returns to “0”.

24. Press and hold the INFRARED open test button on the TB500B. Verify the status is “12 Probe Error”.
25. Release the INFRARED open test button. Verify the status returns to “0”.
26. EXIT the diagnostic screen.
27. Select CO_2/SpO_2 in the SELECT A SCREEN menu.
28. Verify the Saturation and Pulse values for the following TB500B Saturation settings. Verify the pleth waveform is consistent and free of noise.

Test Box Switch Settings		Saturation
Saturation Setting	Signal Attenuation	Tolerance Range
100	3	98 - 100
82	3	80 - 84
62	3	60 - 64
72	7	68 - 76
92	7	88 - 96

Verify Pulse rate is 60 ± 1 for all settings

29. Disconnect the TB500B from the unit and turn it OFF.

5.4 Flow Testing

30. Turn the knob until the FLOW/PAW screen is displayed.
31. Connect the 500ml calibration syringe to the NICO sensor.
32. Pump the calibration syringe back and forth with a steady motion at a rate of 20 cycles per minute. Verify the Vte and Vti are 500 ± 25.
33. Disconnect the 500ml calibration syringe from the NICO sensor.
34. Press and hold the MENU and DATA ENTRY keys simultaneously until the CONFIGURATION MENU appears. Select DIAGNOSTIC SCREENS, then select FLOW.
35. Connect the 9695-48 Leak Test Adapter to the unit.
36. Pull the syringe back.
37. Set the stop cock open.
38. Push in the syringe until the airway pressure (Paw) reads 100cmH_2O.
39. Close the stop cock.
40. Verify the pressure remains above 90 mmH_2O after 30 seconds.

5.5 Time / Date Setting

41. Press the Menu button. Verify the select a screen menu is displayed.
42. Select the setup screen. Verify the setup screen is displayed.
43. Select SET TIME & DATE option. Follow the instructions and set the correct time and date. Exit the SET TIME & DATE screen then exit the setup screen.

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6 Electronic Tests

The Electronic Tests verify the calibration and operation of the electronic circuits within the Model 7300. These tests DO NOT need to be performed on a regular (preventative) basis. Perform these tests only if the monitor fails to operate as expected or fails the Accuracy Tests or the Functional Tests. The Electronic Tests should be performed only by qualified service personnel.

The Electronic Tests require access to the internal components of the monitor. Refer to the Maintenance section for disassembly instructions.

CAUTION: The Model 7300 contains static sensitive devices. Be sure to follow proper grounding procedures when handling the internal components to avoid damage from static discharge.

This procedure assumes the technician performs each step as indicated - leaving the monitor in a known state prior to performing the next step. If steps are omitted or performed out of order, be sure that the monitor is set to the correct state before continuing.

6.1 Equipment Required

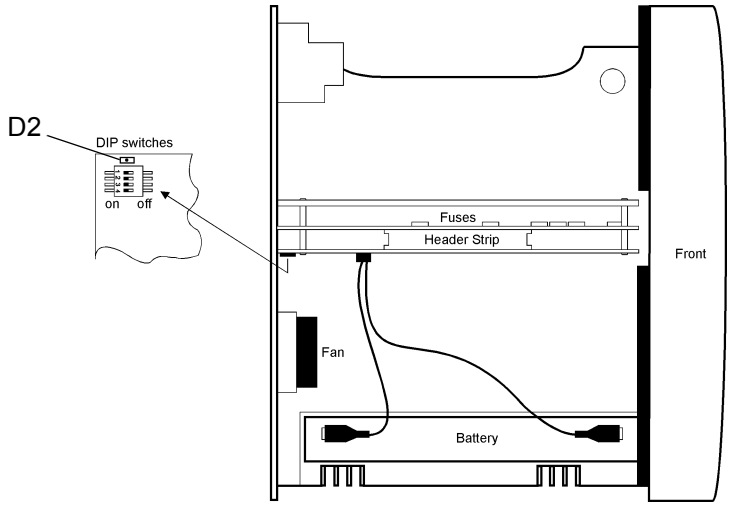
1. TB1265 Sensor Simulator, PN: 5776-00
   The Novametrix TB1265 Sensor Simulator emulates a functioning CAPNOSTAT CO_2 Sensor, and can be used in place of the CAPNOSTAT CO_2 Sensor for monitor test purposes. The TB1265 will verify the functionality of the monitor's CO_2 front end circuitry. Certain error conditions can be simulated to verify responses from the monitor under test.
   The TB1265 is an optional test device and is not mandatory for testing the Model 7300. Its purpose is to increase test efficiency by simulating a working CAPNOSTAT. The TB1265 Sensor Simulator is available from Novametrix Service Department.
2. TB1265 Adapter cable, PN: 5776-48
3. Current limit test jack, PN: 5693-48
4. TB500B Saturation simulator, PN: 5530-00
   This is the same device used by the factory technicians to calibrate the monitor prior to shipping. The TB500B is an updated version of the TB500A Test Box. The TB500A, used in conjunction with adapter cable (Cat. No. 5453-00), may be substituted for the TB500B in most parts of this test.
5. Optical encoder "5" test jack, PN: 9635-48
6. Optical encoder "A" test jack, PN: 9635-14
7. Pressure source, Penwalt pneumatic calibrator model 65-120 or equivalent
8. Common mode test jack, PN: 9638-48

9. Differential test jack, PN: 9636-48
10. Plug test fixture, PN: 9645-48
11. Shorted saturation test jack, PN: 6573-48
12. Oscilloscope
13. 30 ohm 10 watt resistor
14. 100 ohm 2 watt resistor
15. Digital Volt Meter (DVM)
16. Leakage Tester

6.2 Power Supply

In this procedure the term “select” refers to highlighting a selection on the screen by turning the knob, then pressing it in to select the highlighted option.

1. Connect the monitor to the AC line. Set the rear panel power entry module switch ON. Verify the AC LED turns on.
2. Press the power switch. Verify the display shows the NICO start up routine followed by the main display screen.
3. Set switches 2 and 3 on S1 on the 2763-01 board to the “ON” position. Verify the red LED (D2) flashes.



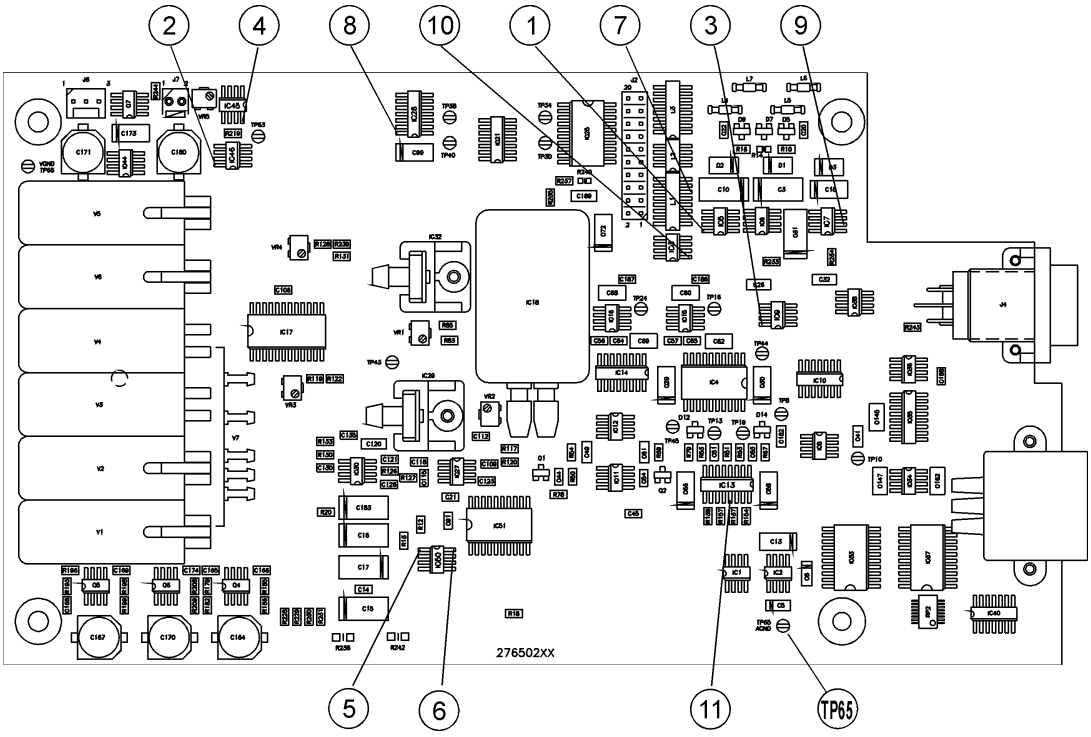
4. Using a DVM, measure the power supply voltage at J6 pin 1 on the 2764-01 board (Use TP1 on the 2763-01 board for ground reference). Verify 15.00V ± 1V.
5. Disconnect the connectors battery from the battery terminals. Measure the voltage at the positive battery terminal connector. Verify 12.6V ± 500mV.
6. Connect the 100 ohm resistor across the battery terminal connectors from J7. Measure the voltage and verify 13.77V ± 500mV. Remove the resistor.
7. Connect the 30 ohm resistor across the battery terminal connectors from J7. Using an oscilloscope, verify pulses present, the peak of the pulses should not be higher than 13.77V ± 500mV.

8. Disconnect the resistor. Position the battery cables from J7 in such a manner so that they do not short against anything.

6.3 Voltage Checks

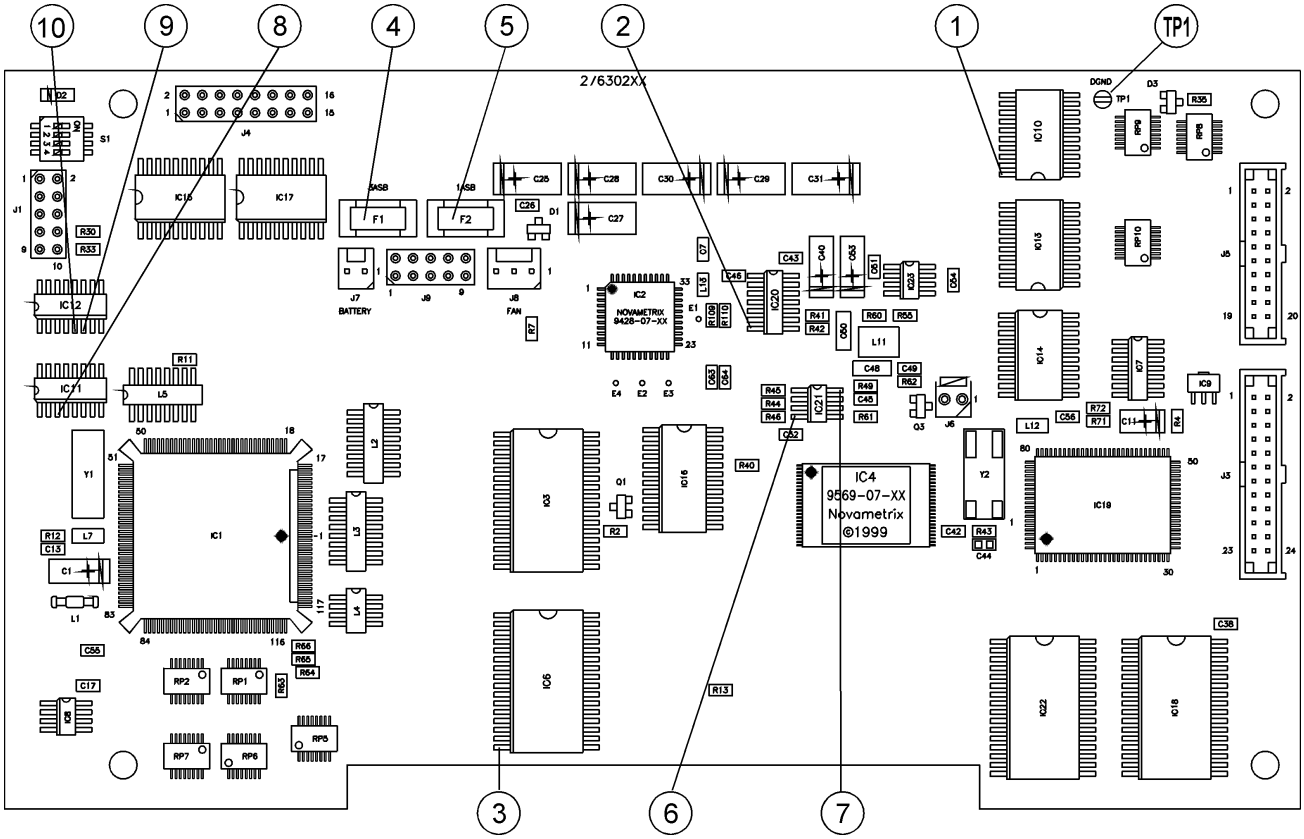
9. Use TP65 on the 2765 board as ground reference for all measurements unless otherwise specified. Measure the following power supply voltages using a DVM:

	Supply Name	Location	Voltage Range
1	VDD	IC5 pin 8	5.00V ± 150mV
2	VVDD	IC46 pin 8	5.00V ± 150mV
3	CVDD	IC9 pin 8	5.00V ± 150mV
4	DISPVA	IC45 pin 8	12.15V ± 500mV
5	AVCCIN	IC50 pin 8	16.00V ± 2.50V
6	AVCC	IC50 pin 1	12.00V ± 500mV
7	VCAPNO	L1 pin 6	12.00V ± 500mV
8	FVDD	IC26 pin 14	5.00V ± 200mV
9	-VA	IC7 pin 2	-16.00V ± 2.50V
10	-VCAPNO	IC3 pin 1	-12.00V ± 500mV
11	-AVCC	IC13 pin 13	-5.00V ± 250mV



10. Measure the following voltages on the 2763 board with a DVM, use TP1 as ground reference.

	Supply Name	Location	Voltage Range
1	VDD	IC10 pin 20	5.00V ± 150mV
2	DVDD	IC20 pin 14	5.00V ± 150mV
3	VBACK	IC6 pin 32	4.50V ± 250mV
4	VBATT	F1	12.60V ± 500mV
5	VHTR	F2	12.15V ± 500mV
6	+VA	IC21 pin 8	16.50V ± 2.50V
7	-VA	IC21 pin 4	-16.50V ± 2.50V



6.4 CO_2 Testing

11. Set the TB1265 switches as follows:
    INSPIRED CO2: OFF
    %CO2: 0
    SENSOR LOCATION: A/A
    SOURCE CURRENT: NORMAL
    CO2 MODE: CONTINUOUS
    TEMPERATURE: NORMAL
12. Connect the TB1265 to the monitor using the TB1265 adapter cable.
13. Press the MENU key, then select SETUP.
14. Select CO_2 ZERO NOW. Follow the screen prompts to perform a zero calibration. When the zero calibration is complete, select EXIT.
    NOTE: The CAPNOSTAT CO_2 sensor must reach operating temperature before zeroing.
15. Set the TB1265 simulator controls as follows:
    CO2 MODE: RESPIRATION
    %CO2: 5%
16. Turn the knob to display the CO_2/PLETH screen and verify an $ETCO_2$ value of 41 ± 2 and a RR (respiration rate) of 20 ± 2.
17. Press and hold the MENU and DATA ENTRY keys simultaneously until the CONFIGURATION MENU appears. Select DIAGNOSTIC SCREENS, then select CO2.
18. Verify DET T and CASE T stabilize at 45.00 ± 0.2.
19. Use TP65 as reference and monitor L5 on the 2765 board. Set the TB1265 TEMPERATURE to CASE OVERTEMP. Verify the voltage is at zero volts and CASE T is >50.00 and DET T remains at 45.00 ± 0.2
20. Set the TEMPERATURE back to NORMAL. Verify CASE T stabilizes at 45.00 ± 0.2 within 2 minutes.
21. Monitor L4 on the 2765 board. Set the TB1265 TEMPERATURE to DETECTOR OVERTEMP. Verify the voltage is at zero volts and DET T is > 50.00 and CASE T remains at 45.00 ± 0.2.
22. Set the TEMPERATURE back to NORMAL. Verify DET T stabilizes at 45.00 ± 0.2 within 2 minutes.
23. Verify the SRC CUR is between 220 and 260.
24. Set the TB1265 SOURCE CURRENT to HIGH. Verify the SRC CUR slowly increases to a value between 340 and 380 and the CASE T and DET T are < 42.00.
25. Set the SOURCE CURRENT back to NORMAL. Verify SRC CUR is between 220 and 260 and CASE T and DET T slowly rise and stabilize at 45.00 ± 0.20 within two minutes.
26. Disconnect the TB1265 from the monitor.

6.5 SpO_2 Testing

27. Select SpO_2 from the CO2 DIAGNOSTIC SCREEN.

28. Connect the current limit test jack to the monitor. Verify the LED n the fixture is on.
29. Press the switch on the current limit test jack. Verify the red LED turns off.
30. Remove the current limit test jack.
31. Verify the STATUS is “9 Probe Xconnect”.
32. Set the controls on the TB500B as follows:
    SENSOR TYPE: 87XX
    SIGNAL ATTENUATION: 3
    SATURATION SETTING: 100
    POWER: ON
33. Connect the TB500B to the monitor.
34. Set the saturation switch on the TB500B to “0”. Verify the status is “2 Low Signal”.
35. Set the saturation switch on the TB500B to “100”. Verify the status returns to “0”.
36. Turn the TB500B OFF. Verify the status line reads “3 Low Light”.
37. Turn the TB500B ON. Verify the status returns to “0”.
38. Press and hold the RED open test button on the TB500B. Verify the status is “13 IR LED FAIL”.
39. Release the RED open test button. Verify the status returns to “0”.
40. Press and hold the INFRARED open test button on the TB500B. Verify the status is “12 Probe Error”.
41. Release the INFRARED open test button. Verify the status returns to “0”.
42. EXIT the diagnostic screen.
43. Select CO_2/SpO_2 in the SELECT A SCREEN menu.
44. Verify the Saturation and Pulse values for the following TB500B Saturation settings. Verify the pleth waveform is consistent and free of noise.

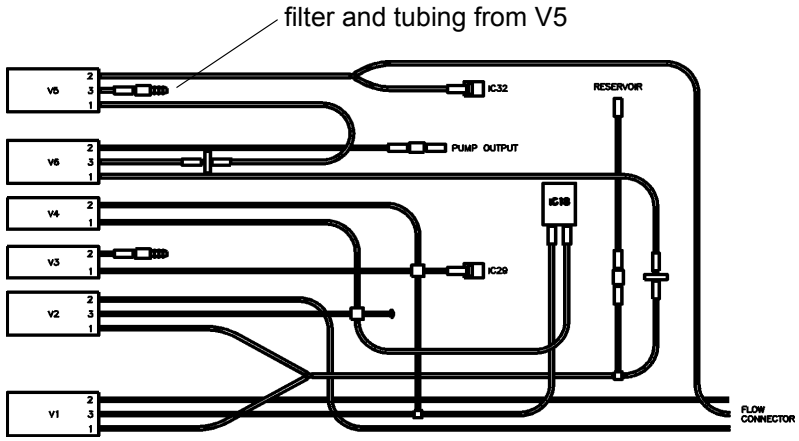
Test Box Switch Settings		Saturation
Saturation Setting	Signal Attenuation	Tolerance Range
100	3	98 - 100
82	3	80 - 84
62	3	60 - 64
72	7	68 - 76
92	7	88 - 96

    Verify Pulse rate is 60 ± 1 for all settings
45. Disconnect the TB500B from the unit and set POWER: OFF.

6.6 Flow, Barometric Pressure and Rebreathe Valve Testing

46. Press and hold the MENU and DATA ENTRY keys simultaneously until the CONFIGURATION MENU appears. Select DIAGNOSTIC SCREENS, then select FLOW.
47. Verify SENSOR is “(0) NONE”.
48. Connect the “5” test jack to the monitor. Verify “(5) Unknown” is displayed.
49. Connect the “A” test jack to the monitor. Verify “(10) Unknown” is displayed.
50. Record the current barometric pressure from the calibrated barometer.

51. Adjust VR3 on the 2765 board if necessary until the TOT PRESS equals the current barometric pressure.
52. Select ZERO. Verify the BARO PRESS equals the value from the previous step. Readjust VR3 if necessary.
53. Connect the differential test fixture to the monitor.
54. Set the pneumatic calibrator for an output pressure of 20 cmH_2O. Connect the pneumatic calibrator output to the left port of the differential test fixture.
55. Adjust VR1 on the 2765 board for a 20b ADC value of 412160 counts ± 1280 counts.
56. Switch the pneumatic calibrator from the left port to the right port on the differential test fixture.
57. Verify a 20b ADC value of 412160 counts ± 12800.
58. Disconnect the differential test fixture.
59. Set the pneumatic calibrator for an output pressure of 80 cmH_2O. Connect the common mode test fixture. Connect the pneumatic calibrator output to the common mode test fixture.
60. Adjust VR2 on the 2765 board for an PAW of 80.00 cmH_2O ± 0.1 cmH_2O.
61. Remove the filter and tubing from V5 on the 2765 board. Replace with the plug test fixture.



62. Set the pneumatic calibrator for an output pressure of 120 cmH_2O. Connect the pneumatic calibrator to the NICO port on the common mode test fixture.
63. Adjust VR4 on the 2765 board for a PRESS2 ADC value of 120 cmH_2O ± 1.0 cmH_2O.
64. Disconnect the common mode test fixture and the plug test fixture.
65. Reconnect the filter and tubing to V5 on the 2765 board.
66. Connect the NICO sensor to the monitor. Select REBREATHE.
67. Verify the pump starts and the PRESS2 ADC rises above 120. Select REBREATHE again, verify the PRESS2 ADC drops to 0.
68. Disconnect the NICO sensor.

6.7 Serial / Analog Testing

69. Verify switches 2 and 3 of S1 are “ON”, verify LED D2 is blinking on the 2763 board.
70. From the DIAGNOSTIC SCREENS select SYSTEM, verify the Analog Connected status is “NO”.
71. Connect pins 8 and 15 together on the rear panel ANALOG connector. Verify the Analog Connected status is “Yes”.
72. Connect pins 2 and 11 together on the rear panel ANALOG connector. Select ANALOG from the SYSTEM DIAGNOSTIC SCREEN. Press the knob in to cycle through the different Output values listed, verify the Input values below:

Output	Input
0	0 +5
128	128 ± 5
255	255 ± 5

73. Repeat for the following pin combinations; pins 3 and 12, pins 4 and 13, pins 5 and 14.
74. Connect pins 2 and 3 together on the RS232 “1” connector. Select SERIAL 1, verify TESTING-Ch1 appears followed by PASS-Ch1.
75. Connect pins 2 and 3 together on the RS232 “2” connector. Select SERIAL 2, verify TESTING-Ch2 appears followed by PASS-Ch2.
76. Connect pins 2 and 3 together on the RS232 “3” connector. Select SERIAL 3, verify TESTING-Ch3 appears followed by PASS-Ch3.
77. Select EXIT to leave the DIAGNOSTIC SCREENS.
78. Set switches 2 and 3 on S1 on the 2763-01 board to the “OFF” position. Verify the red LED (D2) stops flashing.
79. Turn the monitor OFF. Reconnect the battery, ensure proper polarity hookup.

6.8 Safety Testing

80. Assemble the unit completely. Ensure there is no loose hardware inside.
81. Measure the monitor leakage current as follows. Verify a leakage current less than 25uA.
    - Monitor grounded
    - Monitor ungrounded
    - Monitor ungrounded with polarity reversed
82. Measure the monitor AC leakage from the shorted saturation test jack to the hot side of the AC line. Verify a leakage current less than 25uA.

7 Maintenance

7.1 General

This section presents information on general maintenance, such as battery and fuse replacement, disassembly and assembly instructions, and system software updates for the Model 7300.

7.2 Maintenance Schedules

The electronic circuits within the Novametrix Model 7300 monitor do not require scheduled calibration or service[1]. However, in order to maximize battery life, the monitor's internal battery should be tested monthly.

7.3 Cleaning and Sterilization

Follow the cleaning and sterilization instructions listed below to clean and/or sterilize the monitor and its accessories.

7.3.1 Monitor

- Turn the monitor off and unplug the line cord from the AC line before cleaning.
- The monitor can be cleaned and disinfected with solutions such as a 70% isopropyl alcohol, 2% glutheralhyde, or 10% bleach solution. Then wipe down with a water-dampened clean cloth to rinse. Dry before use.
- Do not immerse the monitor.
- Do not attempt to sterilize the monitor.

7.3.2 SpO_2 Finger Sensor

- The sensor can be cleaned and disinfected with solutions such as a 70% isopropyl alcohol, 2% glutheralhyde, or 10% bleach solution. Then wipe down with a water-dampened clean cloth to rinse. Dry before use.
- Make certain that the finger sensor windows are clean and dry before reuse.
- Do not immerse the finger sensor.
- Do not attempt to sterilize the finger sensor.
- After cleaning the finger sensor, verify that the sensor is physically intact, with no broken or frayed wires or damaged parts. Make certain that the connectors are clean and dry, with no signs of contamination or corrosion. Do not use a broken or damaged sensor or one with wet, contaminated or corroded connectors.

1. At the customer's request, Novametrix will provide repair and calibration services under terms of a Service Contract. Contact the Novametrix Service Department for contract details.

7.3.3 SpO_2 Y-Sensor

- Do not immerse connector on the Y-Sensor.
- The Y-Sensor may be immersed—up to, but not including, the connector, in a 2% glutheralhyde solution, or 10% bleach solution. Refer to manufacturer's instructions and standard hospital protocols to determine recommended times for disinfection and sterilization.
- Rinse thoroughly with water and dry before use (do not rinse the connector).
- Do not attempt to sterilize Y-Sensor except as stated above.
- After cleaning or sterilizing the Y-Sensor, verify that the sensor is physically intact, with no broken or frayed wires or damaged parts. Make certain that the connectors are clean and dry, with no signs of contamination or corrosion. Do not use a broken or damaged sensor or one with wet, contaminated, or corroded connectors.

7.3.4 SpO_2 Y-Strip Tapes and Foam Wraps

- Treat Y-Strip Tapes and foam wraps in accordance with hospital protocol for single-patient use items.

7.3.5 Ear Clip

- Clean the ear clip with a cloth dampened with 70% isopropyl alcohol. After cleaning, wipe the ear clip down thoroughly with a clean water-dampened cloth to rinse.

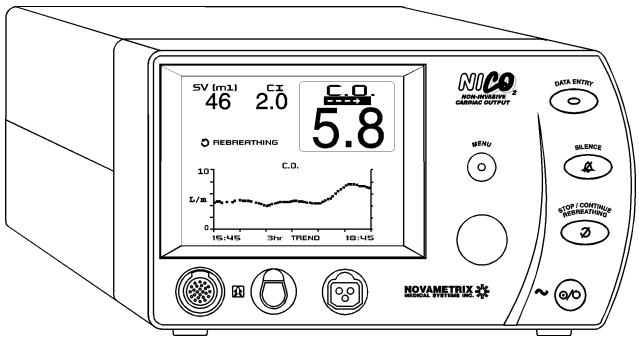
7.3.6 NICO Sensors

- Treat the NICO sensor in accordance with hospital protocol for single-patient use items.
- Do not attempt to reuse, clean or sterilize the NICO sensor.

7.3.7 CAPNOSTAT CO_2 Sensor

- Clean the sensor surface with a damp cloth.
- Make certain that the sensor windows are clean and dry.
- Do not immerse the CAPNOSTAT CO_2 sensor.
- Do not attempt to sterilize the CAPNOSTAT CO_2 sensor.

7.4 Disassembly



CAUTION:

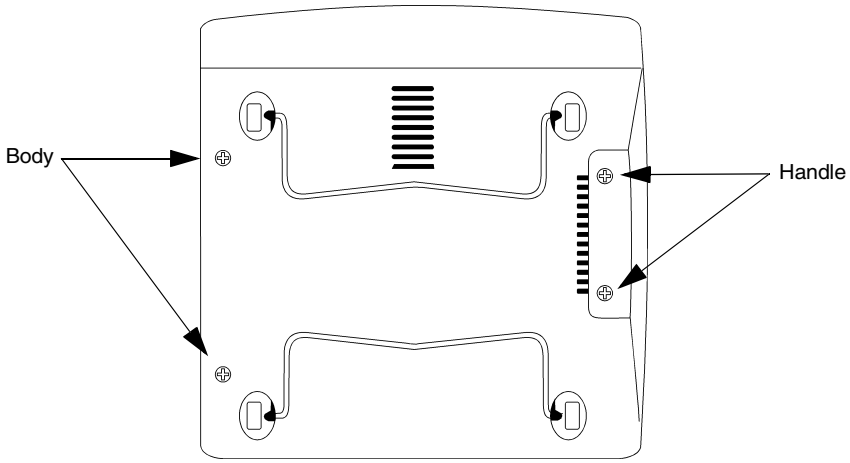
The Model 7300 contains static sensitive devices. Be sure to follow proper grounding procedures when handling the internal components to avoid damage from static discharge.

7.4.1 Equipment Required

- Phillips screwdriver
- Small flat-blade screwdriver

7.4.2 Disassembling Unit

1. Check that the monitor is OFF.
2. Set the rear panel power entry module switch to OFF (“O”). Remove the line cord from the power entry module (if connected).
3. Turn the unit over to expose the bottom; remove two screws from the body of the unit and two more from the handle. NOTE: Body screws are long.



4. Holding the unit together with both hands, turn it right-side up; then slide the top cover off by pulling gently straight up.

5. Place the top cover and screws aside.
6. If necessary the bottom cover can be removed to access to the analog board. It is not recommended to disassemble the unit any further as damage may result.

7.5 Reassembling Unit

1. Check that the line cord is not connected. Verify proper connections on the internal battery.
2. Check that there is no loose hardware or objects within the chassis assembly. Verify all wires and cables are properly secured.
3. Align the top cover with the unit and push down to seat.
4. Holding the unit together with both hands, turn it bottom-side up.
5. Replace two screws in the body of the unit and two more in the handle.
   NOTE: Body screws are longer.

7.6 Battery Maintenance

If the monitor has not been used or powered by AC for an extended time[2] (3 months or more) allow the battery to charge for 12 hours before use. The monitor may not power up on battery power if the battery is not sufficiently charged.

To charge the battery, connect the power cord (see below) and set the rear panel power switch ON ("|"). Check that the front panel AC LED is on. Allow the battery to charge for 12 hours to ensure a fully charged battery in the event that battery power is required.

The AC power line cord shipped with monitors for North America is a Hospital Grade, SJT style cord with a 120 VAC plug. All power line cords shipped with monitors for Europe are the European style with a 220-240 VAC plug. All other style power line cords, as required by the country of destination, are provided by the distributor for that country.

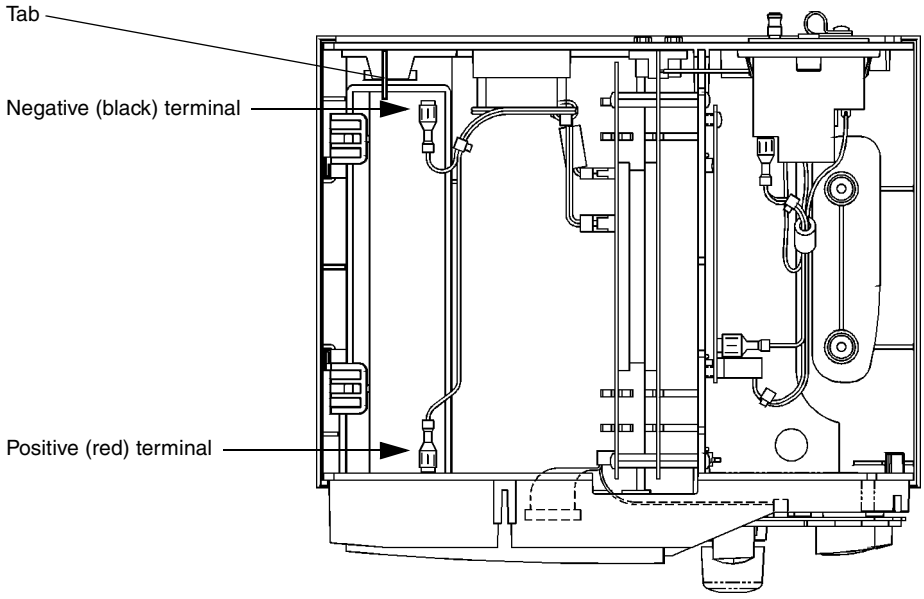
7.7 Replacing the Internal Battery

	Recyclable item. After the life cycle of the item has been met, disposal should be accomplished following national/local requirements.
	Separate collection. Appropriate steps must be taken to ensure that spent batteries are collected separately when disposed of. This symbol is found on the internal battery.
Pb	Indicates heavy metal content, specifically lead. This symbol is found on the internal battery and the monitor enclosure.

1. Remove the line cord from the unit (if installed).

2. The internal battery will slowly discharge over long periods of non-use.

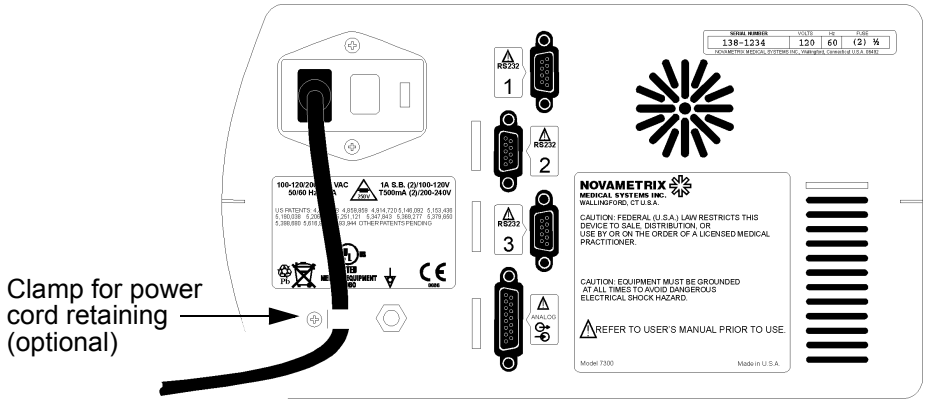
2. With the top cover removed, disconnect the positive then the negative lead from the battery terminals.



3. Newer units will have a tab that extends from the rear panel to the rear edge of the battery. To remove the battery on these units, carefully flex the tab to the left and tilt the battery to the right and pull the battery out. For other units simply slide the battery out by tilting the back up slightly to clear the front edge of the monitor and pulling straight up.
4. Replace the battery and reconnect the negative lead first, being careful to connect the negative (black) lead to the negative (black) terminal on the battery.
5. Connect the positive (red) lead to the positive (red) terminal. The unit may turn on when the positive lead is connected, simply press the power key to turn the unit off.

7.8 Mains Voltage Configuration

The rear panel indicates the mains voltage setting for the monitor. Check that the voltage is correct before attaching the line cord and powering the monitor. The Model 7300 can operate from 100-120 VAC 50/60Hz or 200-240VAC 50/60Hz.


Clamp for power cord retaining (optional)
RS232
1
RS232
2
RS232
3
ANALOG
NOVAMETRIX
MEDICAL SYSTEMS INC.
WALLINGFORD, CT U.S.A.
CAUTION: FEDERAL (U.S.A.) LAW RESTRICTS THIS DEVICE TO SALE, DISTRIBUTION, OR USE BY OR ON THE ORDER OF A LICENSED MEDICAL PRACTITIONER.
CAUTION: EQUIPMENT MUST BE GROUNDED AT ALL TIMES TO AVOID DANGEROUS ELECTRICAL SHOCK HAZARD.
REFER TO USER'S MANUAL PRIOR TO USE.
Model 7300
Made in U.S.A.

Refer to the following section for fuse replacement.

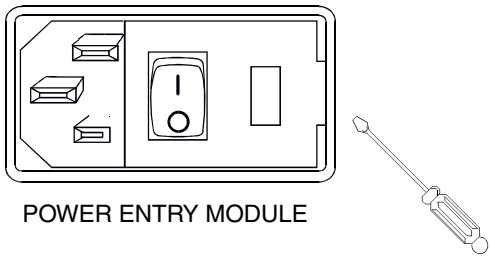
7.8.1 Fuse Replacement

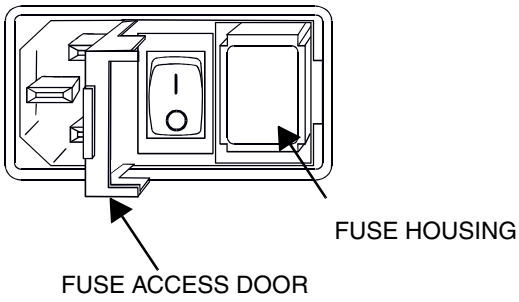
CAUTION:

Replace fuses with same type and rating. Verify proper fuse value for mains voltage setting (see table below).

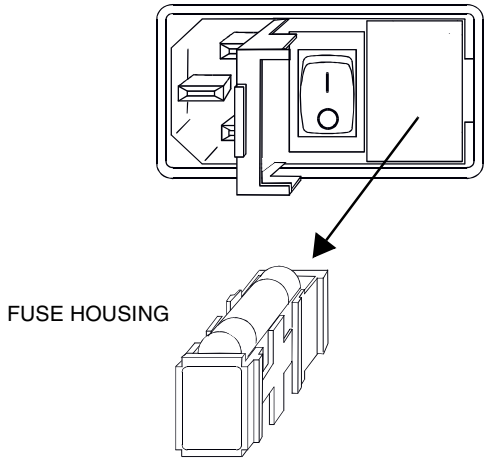
Mains Voltage	Fuses (Slo Blo)	Part No.
100-120 VAC	1.0 A 250V	515005
200-240 VAC	500mA 250V	515095

1. Check that the monitor is OFF.
2. Set the rear panel power entry module switch to OFF (“O”). Remove the line cord from the power entry module (if connected).
3. Using a flat blade screwdriver, pry the fuse access door open to expose the fuse housing.





4. Pry the fuse housing out from the power entry module.



5. Replace the blown fuse(s) with the proper type and rating.
6. Re-install the fuse housing. When positioning the housing into the power entry module ensure that it is oriented correctly. Press the fuse housing back into the power entry module.
7. Close the fuse access door.

7.9 Software Update Instructions

The following procedure is for updating the monitor's software from the supplied *NICO* Software Update Kit using an IBM compatible computer.

7.9.1 Equipment Required

1. IBM compatible computer with an unused serial port (COM1 or COM2)
2. DB-9 male to DB-9 female serial communications cable (Cat. No. 600073)
3. Update diskette PN: 9571-07-XX (XX = new firmware version)
4. Reply card

7.9.2 Setup

1. Connect the serial cable to the rear panel 9 pin connector marked "1" on the *NICO* (see FIG. A).

2. Connect the other end of the cable to the computer's COM[3] (serial) port (see FIG. A). The update software allows use of either COM1 or COM2, the program will request which COM port to use before updating the software.

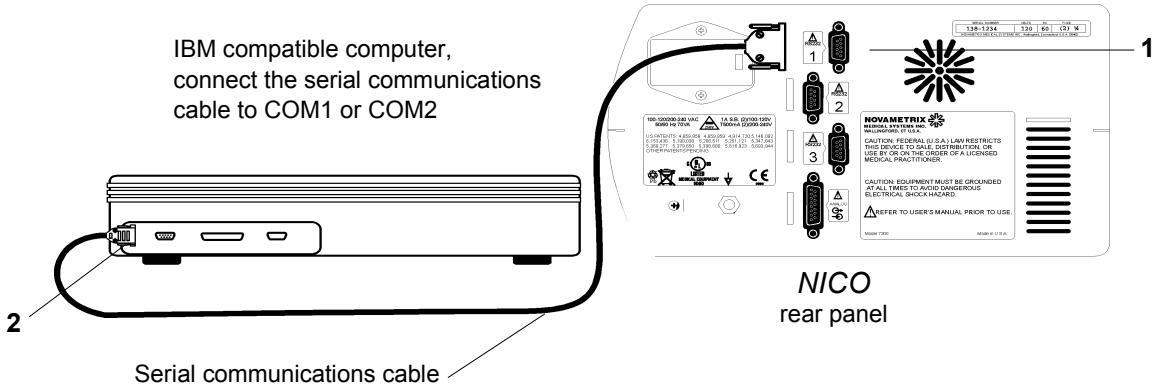


FIG. A

3. Turn the *NICO* on.

7.9.3 Procedure

1. Insert the update diskette into the computer's floppy drive (typically drive A).
2. From DOS: Type A: ↵ (where A is the drive letter where the update diskette is loaded). At the "A:" prompt type UPDATE then press ↵ .

   From Windows 3.x: Boot to DOS and follow the DOS instruction above.

   From Windows 95: Select Start, Run, then type A:update ↵ (where A is the drive letter where the update diskette is loaded)
3. Follow the install program screen instructions. Verify that the firmware version shown on the computer screen is correct, then press any key to continue.
4. When the following prompt appears:

```
Select the PC's COM port the instrument is connected to
from the following choices:
    1-COM1
    2-COM2
    any other key - exit
```

   Press 1 for COM1 or 2 for COM 2. If the download does not start try selecting the other COM port.
   If you are not sure of the process, press any other key and call service or Novametrix Service Department at 1-800-243-3444, in Connecticut call collect (203) 265-7701.

3. The location and availability of the COM ports (COM1, COM2) will vary from computer to computer. Refer to the computer's documentation for more information. The update software can only communicate with the *NICO* through either COM1 or COM2.

5. When the download starts the *NICO* screen will blank and the following message will appear on the computer screen.

   ```
   Validating File
   ```

   then,

   ```
   UPDATING FIRMWARE, DO NOT INTERRUPT. PERCENT DONE: xx%
   ```

   The “xx” will count up from 0% through 100% as the update is completed.

6. The procedure is complete when the computer displays:

   ```
   ***PROGRAM COMPLETE***

    F1-exit          Esc-back
   ```

7. Press F1 to exit the update program.
8. Check that the *NICO* restarts and returns to normal operation, if not then perform the update procedure again or call Novametrix Service Department at 1-800-243-3444, in Connecticut call collect (203) 265-7701.
9. Remove the serial communications cable from the PC and the *NICO*. Record the serial number from the *NICO* on the reply card. Fill in the remaining information and return the postage paid card to Novametrix.

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8 Specifications

8.1 General

Specifications for the Novametrix NICO Monitor, Model 7300, are listed for informational purposes only, and are subject to change without notice.

8.2 NICO

- Measurement Frequency: Rebreathing cardiac output measurement made every three minutes, rebreathing period is 50 seconds.
- Cardiac Output Range: 0-19.9 liters/minute
- Cardiac Output Resolution: 0.1 liters/minute
- Pulmonary Capillary Blood Flow (PCBF) Range: 0-19.9 L/min, Resolution: 0.1 L/min
- Cardiac Index Range: 0-9.9 L/min/meter^2, Resolution: 0.1 L/min/meter^2
- Stroke Volume Range: 0-250 ml, Resolution: 1 ml
- Rebreathing Valve/sensor:
  - Valve type: dual diaphragm, pneumatically controlled
  - Return spring: automatically returns valve to normal position
  - Resistance: 3cmH_2O/L/min maximum
  - Rebreathed volume: normal position 35ml; rebreathing position 150-450ml (large)
  - CO_2/flow sensor: integrated into valve assembly
- Parameter limits for NICO measurements:
  - VCO_2: >20 ml/min
  - RR: >3, <60
  - Vt: >200
  - $ETCO_2$: >15, <70 mmHg

8.3 CO_2

- Principle of Operation: Non-Dispersive Infrared (NDIR) absorption, dual wavelength ratiometric-single beam optics, mainstream sensor.
- Response Time: Less than 60 ms
- Gas composition effects: Operator selectable
- CAPNOSTAT® CO_2 Sensor:
  - Weight: Less than 18 g without cable
  - Sensor Size: 1.3 x 1.67 x .85 inches (3.3 x 4.2 x 2.2 cm), 8 foot cable (2.44 m)
  - Construction: Durable high performance plastic, ultra-flexible cable Shock Resistant: Sensor will withstand a 6 foot drop to a tile floor

- End Tidal CO_2:
  - Range: 0-150 mmHg, 0-20 kPa or %
  - Accuracy: ± 2 mmHg for 0-40 mmHg, ± 5% of reading for 41-70 mmHg, ± 8% of reading for 71-150 mmHg
- Respiratory Rate:
  - Range: 1-150 breaths/min
  - Accuracy: ± 1 breath/min

8.4 Flow Sensor

- Flow Range: 2 to 180 L/min @ Barometric Pressure 760 mmHg, room air, 35°C
- Flow Accuracy: Greater of ± 3% reading or .5 L/min
- Minute Volume Range: 2 to 60 L/min
- Tidal Volume Range: 100 to 3000 ml
- Airway Pressure Range: -120 to 120 cmH_2O

8.5 SpO_2

- Oxygen Saturation
  - Range: 0-100%
  - Accuracy: ± 2% for 80-100% (± 1 standard deviation), unspecified for 0-79%
  - Averaging Time: 2 seconds
- Pulse Rate:
  - Range: 30-250 beats per minute
  - Accuracy: ± 1% of full scale
  - Averaging Time: 8 seconds

8.6 Monitor Specifications

- Classification (IEC601-1): Class I/internal power source, type BF, continuous operating mode
- Operating Environment: 50-95° F (10-35° C), 0-90% relative humidity (non-condensing)
- Size: Height 6.5 in., Width 10.75 in., Depth 9.5 in.
- Weight: 10 pounds
- POWER: 100-240 VAC, 50-60 Hz, 40VA
- Fuse Rating: 100-240 VAC, 0.5 A 250 V Slo-Blo (x2); 200-240 VAC, T 250 mA/ 250 V (x2)
- Battery: Internal, Sealed lead-acid gel-cell, 45 minute life on full charge (on-screen life indicator), 12 hours recharge time.
- Display: 4.625 x 3.5 inch EL, 320x240 pixels
- Electromagnetic Emissions: Conforms to EMC Directive 89/336/EEC, CISPR Class A. Tested to EN55011 (1991) and CISPR11 (1990).
- Electromagnetic Immunity: Conforms to EMC Directive 89/336/EEC, EN50082-1 (1992). Tested to IEC801-3 (1984) Radiated Immunity. Conforms to Medical Device Directive 93/42/EEC EN60601-1 (1992). Tested to IEC801-2 (1991) ESD, IEC801-4 (1988) EFT, and IEC1000-4-5 (1995) Surge Immunity.

9 NICO Accessories

Catalog No.	Description
9226-00	***NICO*** **Non-Invasive Cardiac Output Monitor**, Model 7300 Includes: Monitor, *CAPNOSTAT* CO_2 Sensor, SpO_2 Sensor, Power Cord and User's Manual.
8951-00	***NICO*** **Sensors** (10 per box) **Standard size (for tidal volumes of 450 - 1400 mL)**
9567-00	***CAPNOSTAT®*** **CO_2 Sensor**
6934-00	**Cable Management Straps** for use with the CAPNOSTAT CO_2 Sensor. Organizes and holds multiple cables and tubings. (package of 5)
8751-00	***CAPNOSTAT®*** **CO_2 Sensor Cable Holding Clips** (50 per box)
8776-00	***SuperBright***™ **Finger Sensor** (10 ft. sensor cable) 1 yr. warranty
8791-00	***SuperBright***™ **Y-Sensor** (10 ft. sensor cable) 90 day warranty
4941-00	**Saturation Sensor Extension Cable** (4 feet)
4942-00	**Saturation Sensor Extension Cable** (6 feet)
4943-00	**Saturation Sensor Extension Cable** (10 feet)
5266-00	**Saturation Sensor Extension Cable** (25 feet)
6147-00	**Saturation Sensor Extension Cable** (50 feet)
8828-00	**20mm Wrap Style Taping System** (100 per box) **for use with Y-Sensor** Use on neonatal foot and hand, or on pediatric toe or finger, color coded blue
8829-00	**25mm Wrap Style Taping System** (100 per box) **for use with Y-Sensor** Use on neonatal foot and hand, color coded green
8831-00	**20mm Finger Style Taping System** (100 per box) **for use with Y-Sensor** Use on pediatric finger or on small adult finger, color coded blue
8832-00	**25mm Finger Style Taping System** (100 per box) **for use with Y-Sensor** Use on adult finger, color coded green
6929-00	**Adhesive Foam Wraps**, Large (25 per box) **for use with Y-Sensor**
6968-00	**Adhesive Foam Wraps**, Small (25 per box) **for use with Y-Sensor**
8836-00	**Non-Adhesive Foam Wraps**, Large (25 per box) **for use with Y-Sensor**
8943-00	**Non-Adhesive Foam Wraps**, Small (25 per box) **for use with Y-Sensor**
6131-50	**Ear Clips** (5 per box) **for use with Y-Sensor**
6131-25	**Ear Clips** (25 per box) **for use with Y-Sensor**
8700-00	**Adhesive Dots** (200 per box)
600026	**Power Cord** (included with monitor)
9226-23	***NICO*** User Manual
9226-90	***NICO*** Service Manual

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10 Parts Lists

10.1 9226-00 Non-Invasive Cardiac Output Monitor, Model 7300

Item	Part No.	Description	Quantity
001	1003-32	LABEL, SERIAL NUMBER	1
002	1217-32	REPAIR LABEL	1
003	4470-32	LABEL, CAUTION GROUNDING	1
005	9026-32	LABEL, MANUFACTURED IN USA	1
006	9226-01	MAIN ASSY	1
014	9486-32	LABEL SET, REAR PNL, 7300	1
015	9487-32	TOP COVER LABEL, 7300	1
016	9501-13	FACADE W PAD PRINT, 7300	1
027	315032	LABEL, 120VAC, 10MM X 20M	1
028	600026	LINE CORD, AC, 7 1/2 FT, 120 VAC	1

10.2 9226-01 Main Assy

Item	Part No.	Description	Quantity
001	2763-01	DIGITAL BOARD ASSY	1
002	2764-01	POWER BOARD ASSY	1
003	2765-01	ANALOG BOARD ASSY	1
004	2766-01	C02 INPUT BOARD ASSY	1
005	5760-16	LEFT FOOT, WHITE, KICKSTAND	2
006	5761-16	RIGHT FOOT, WHITE, KICKSTAND	2
007	5826-10	FOOT PAD, BOTTOM COVER	4
008	9306-27	SILICONE KEYPANEL	1
009	9335-10	GASKET, PCB, 7300 - NICO	1
010	9336-10	KICKSTAND, 7300 - NICO	2
011	9337-10	GASKET, DISPLAY, 7300 - NICO	1
012	9379-01	FAN & BTRY HARN ASSY, 7300	1
013	9392-01	PUMP W RSVR ASSY, 7300	1
014	9419-01	CABLE ASSY, PWR ENTRY MODULE	1
015	9420-01	CABLE ASSY, DC PWR, 7300	1
016	9486-16	REAR PANEL, 7300 - NICO	1
017	9487-16	TOP COVER, 7300 - NICO	1
018	9488-16	BOTTOM COVER, 7300 - NICO	1

Item	Part No.	Description	Quantity
019	9489-16	MAIN FRAME, 7300 - NICO	1
020	9490-16	BEZEL, MODEL 7300 - NICO	1
021	9492-01	KNOB ASSY, MODEL 7300	1
031	161060	EPOXY, 2 PART (5/7), GRAY	0
032	161067	TAPE, CL CELL	0
033	210157	PWR MODULE, D FUSE, ON/OFF	1
034	216074	CONNECTOR, PLUG, POT COMP	1
035	280244	STANDOFF, 1/4 HEX X 11/16	0
036	280245	STANDOFF, 1/4 HEX X 11/16	0
037	280246	STANDOFF, . I8DIA X 11/16L	0
038	161007	ADHESIVE, 414, HIGH STRENGTH	0
039	284007	SCR, 4-24 X IL, PAN HD	0
040	284008	SCR, 4-24 X 5/16L, PAN HD	0
041	284009	SCR, 4-24 X 1/4L, PAN HD	0
042	284252	#4-40 X 3/8 OVAL HEAD PHIL	0
043	284261	SCREW, 4-40 X 5/8 L, PHIL	0
044	285051	WASHER, .500 DIA X .120	0
045	286005	5CR, 6-32 X 1/4L, PAN HD	0
046	286006	SCR, 6-32 X 5/16L, PAN HD	0
047	286010	5CR, 6-32 X 4 3/4L, PAN HD	2
048	286011	SCR, 6-20 X 5/16L, PAN RD	0
049	286012	5CR, 6-32 X 3/4L, PAN HD	0
050	400024	BATTERY, 12V DC, 2.3 AMP	1
051	400056	PWR SUPPLY, 15 VOC OUT	1
052	482610	EL DISPLAY, THIN FILM	1
053	510016	SWITCH, ROTARY ENCDR	1
054	600078	RIBBON CABLE, 24 PIN, RCP	1
055	600079	RIBBON CABLE, 20 PIN, RCP	1
056	600080	RIBBON CABLE, 40 PIN, RCP	2
057	608001	CABLE TIE, .094 X 3.62L	0
058	608128	CABLE CLAMP. .312 DIA CAB	1
059	216077	TERMINAL LUG, RING, .250	1
060	515005	FUSE, LA, 250V, SLO-BLO	2

10.3 2763-01 Digital Board Assy

Part No.	Description	Quantity
486037	IC, HM628128LFP-12, 128K	2
474233	RESISTOR, 10K OHM, 1/16W	25
180034	FERRITE FILTER, 4 LIN, EMI	2
486790	IC1 TLE2022CD, DUAL OP AMP	1
180029	INDUCTOR, 50MHZ CUT-OFF	5
180030	INDUCTOR, CAP, 4700PF, 50V	1

Part No.	Description	Quantity
474242	RESISTOR, 249K OHM, 1/16W	1
486314	IC, MC74HC541DW, OCTAL BUFFER	2
486348	IC, MM74HC4040M, 12-STAGE	1
474227	RESISTOR, 1K OHM, 1/16W	5
486042	IC, AT93C66-I0SC, SERIAL	1
154112	CAPACITOR, .047UF, I6VDC	3
483019	TRANSISTOR, MMBT2907ALTI	1
474247	RESISTOR, 10M OHM, 1/16W	1
482551	LED, RED, WITH LENS, SURF	1
230024	CRYSTAL, 32.768 KHZ, SURF	1
486320	IC, SN74HCl4D, HEX SCHMIT	1
474231	RESISTOR, 4.99K OHM, 1/16	2
474240	RESISTOR, 100K OHM, 1/16W	8
481546	DIODE, SWITCHING, SURF MT	2
487094	IC, RTC-62423, REAL TIME	1
474194	RESISTOR, 2.2M OHM, 1/16W	1
180035	FERRITE FILTER, 8 LINE	3
180022	INDUCTOR, 10UH, 10%, SURF MT	1
487132	IC, TL7757CPK, SPLY V ROL	1
487114	IC, MC34119D, AUDIO AMP	1
154108	CAPACITOR, 100PF, 50VDC	4
486481	IC, TLC5620CD, QUAD 8-B	1
211213	CONNECTOR, 2 PIN, POST	1
154072	CAPACITOR, .lUF, 50V, 10%	2
154104	CAPACITOR, .01UF, 50vDC	30
154079	CAPACITOR, 10UF, 25V, 10%	3
154116	CAPACITOR, 10UF, 35V, 10%	6
474225	RESISTOR, 499 OHM, 1/16W	1
513010	SWITCH, SLIDE, SPDT, 4 SW	1
485532	TRANSISTOR, 2N7002T1	2
474236	RESISTOR, 33.2K OHM, 1/16	2
474235	RESISTOR, 24.9K OHM, 1/16	3
486323	IC, SN74HC573DW, OCTAL	3
487138	IC, GRAPHICS LCD CONT	1
486365	IC, MICROCONTROLLER	1
474313	RES PACK, 10K OHM, .1W	3
474316	RES PACK, 100K OHM, 3/4W	1
474311	RES PACK, 51 OHM, .1W	6
212543	CONNECTOR, 20 PIN, HEADER	1
486367	IC, DECADE COUNTER, HIGH	1
486055	IC, STATIC RAM, 4M BIT	2
2763-02	FAB, DIGITAL BOARD	1
2763-03	SCHEMATIC, DIGITAL BOARD	0
212610	CONN, 24 PIN, HEADER	1

Part No.	Description	Quantity
2763-04	TEST PROC, DIGITAL BD	0
210156	CONNECTOR, 96 PIN, HEADER	1
216029	TEST POINT, SPRING LOADED	1
211327	CONNECTOR, 3 PIN, HEADER	1
9428-07	PROGRAM, CPLD	1
515094	FUSE WITH FUSEHOLDER, 3A	1
9569-07	PRGM, B CODE & SYS, 7300	1
153006	CAPACITOR, 47PF, 63V	1
5150S7	FUSE w FUSEHOLDER, lA	1
154069	CAPACITOR, 4.7UF, 10V	1
154105	CAPACITOR, 47PF, 50VDC	1
180062	FERRITE BEAD, 1K OHMS	1
154106	CAPACITOR, 22PF, 50VDC	5
154106	CAPACITOR, 22PF, 50VDC	4
474222	RESISTOR, 10 OHM, 1/16w	3
474222	RESISTOR, 10 OHM, 1/16w	2
474224	RESISTOR, 100 OHM, 1/16w	44
474224	RESISTOR, 100 OHM, 1/16W	46
154119	CAP, 6.8PF, 50V, 5%, NPO	6
154119	CAP, 6.8PF, 50V, 5%, NPO	9

10.4 2764-01 Power Board Assy

Part No.	Description	Quantity
487100	IC, TCl426COA, INV DUAL	1
481557	DIODE, MBRSll00T3, SCHOTT	2
484557	VOLTAGE REGULATOR, LT1117	1
154106	CAPACITOR, 22PF, SOVOC	1
474241	RESISTOR, 150K OHM, 1/16W	3
154110	CAPACITOR, 3.3NF, SOVOC	1
486325	IC, MC14093BD, QUAD 2-IN	1
154111	CAPACITOR, .1UF, 16VOC	4
486825	IC, LMC7101BIM5X, OP AMP	2
486346	IC, TC7SOOFTE85L, 2-IN	2
152085	CAPACITOR, 1500UF, 16V	2
212307	CONN, 15 P, D-SUBMIN, RT	1
154093	CAPACITOR, 68UF, 16VOC	2
481549	DIODE, M~RS140T3, RECT	5
152096	CAPACITOR, 220UF, 35V,	12
486790	IC, TLE2022CD, DUAL OP AMP	2
486340	IC, TLC2543CDW, 12 BIT	1
515088	FUSE W FUSEHOLDER, 1/16A	1
484061	TRANSISTOR, MMBT2222ALT1	5

Part No.	Description	Quantity
474242	RESISTOR, 249K OHM, 1/16W	4
474265	RESISTOR, 1 OHM, 1/4W, 1%	1
481555	DIODE, MMBD7000LT1, DUAL	11
486314	IC, MC74HC54lDW, OCTAL BU	1
484565	IC, LTI170CQ, VOLTAGE REG	1
154081	CAPACITOR, 100PF, 100V	6
486326	IC, MCl40l3BD, DUAL D FLI	1
471400	RESISTOR, lOOM OHM, 1W	1
474238	RESISTOR, 37.4K OHM, 1/16	4
474259	RESISTOR, 15K OHM, 1/16W	1
485546	TRANSISTOR, VN0605T, N-CH	2
483019	TRANSISTOR, MMBT2907ALT1	1
487104	IC, TC4404COA, DUAL	1
484541	VOLTAGE REGULATOR, LM317L	1
485541	TRANSISTOR, SI4947DY, MOS	4
180045	INDUCTOR, 220UH, 20%	2
486796	IC, TLC2272CD, DUAL OP AM	1
474247	RESISTOR, lOM OHM, 1/16W	1
486805	IC, LM393M, DUAL VOLTAGE	2
486785	IC, LP339M, QUAD VOLTAGE	1
486320	IC, SN74HCl4D, HEX SCHMIT	2
515085	FUSE W FUSEHOLDER, 2A	2
481046	DIODE, ZENER, MMSZ5236BTI	1
474240	RESISTOR, 100K OHM, 1/16W	26
474261	RESISTOR, 7.5K OHM, 1/16W	2
154086	CAPACITOR, 4.7UF, 10VDC	2
481546	DIODE, SWITCHING, SURF MT	5
180035	FERRITE FILTER, 8 LINE	1
474197	RESISTOR, 49.9K OHM, 1/16	2
484062	TRANSISTOR, MMBT2369LT1	1
484562	IC, LT1I7SCS8-ADJ, MICRO	1
484563	IC, LTIII7CST, VOLTAGE	1
484543	VOLTAGE REGULATOR, MC78L05	1
180022	INDUCTOR, 10UH, 10%, SURF MT	3
486821	IC, AD822AR, FET-IN OP AMP	1
180047	INDUCTOR, 50 OHMS @ 100M	8
210070	CONN, 96 PIN, RCPT, STR	1
485543	TRANSISTOR, MOSFET, N-CHAN	2
153045	CAPACITOR, .47UF, 50V	1
515087	FUSE W FUSEHOLDER, lA	1
481556	DIODE, MMBD354LT1, DUAL	1
474239	RESISTOR, 75K OHM, 1/16W	1
154108	CAPACITOR, 100PF, 50vDC	3
486781	IC, TLO72CD, OP AMP, JFET	1

Part No.	Description	Quantity
486481	IC, TLC5620CD, QUAD 8-B D	1
486813	IC, TLC2274AID, QUAD FET	1
6756-10	TRANSFORMER, MAIN BOARD	1
154072	CAPACITOR, . 1UF, 50V, 10%	9
180019	INDUCTOR, 100UH, 10%, SUR	1
474193	RESISTOR, 8.87K OHM, 1/16	1
153063	CAPACITOR, 220PF, 3KV. 20	2
481548	DIODE, EGL41B, RECTIFIER	4
486828	IC, LT1460HCS3-2.5, UPOWE	2
486321	IC, SN74HC138D	2
486313	IC, MC14066BD, QUAD ANALOG	1
216029	TEST POINT, SPRING LOADED	6
154116	CAPACITOR, IOUF, 35V, 10%	16
474234	RESISTOR, 20.5K OHM, 1/16	2
474225	RESISTOR, 499 OHM, 1/16w	13
487103	IC, TC4405COA, DUAL	1
481036	DIODE, ZENER, 1N5366B	1
474243	RESISTOR, 324K OHM, 1/16W	2
474195	RESISTOR, 511K OHM, 1/16W	7
212108	CONNECTOR, 10 PIN, HEADER	1
485532	TRANSISTOR, 2N7002T1	11
474236	RESISTOR, 33.2K OHM, 1/16	5
474235	RESISTOR, 24.9K OHM, 1/16	5
486323	IC, 5N74HC573DW	2
486363	IC, QUAD UNIV ASYNCH XCVR	1
486364	IC, 8 BIT A TO D CONV	1
486831	IC, PRECISION 2.5V REF	1
154118	CAP, 33PF, 50V, 5%, NPO	1
474316	RES PACK, 100K OHM, 3/4W	3
474311	RES PACK, 51 OHM, .1W	1
474312	RES PACK, 1K OHM, .1W	2
474302	RESISTOR, 150 OHM, .33W	1
474304	RESISTOR, 470K OHM, .33W	1
474305	RESISTOR, 470 OHM, .75W	2
474306	RESISTOR, 26.7 OHM, .33W	1
474307	RESISTOR, 3.32 OHM, .33W	1
474308	RESISTOR, 5.6 OHM, .33W	1
230028	CRYSTAL, 7.3728 MHZ, 20PF	1
180057	INDUCTOR, 22UH, 20%, .05	1
486369	IC, 5V RS232 4-DRIVER	1
487145	IC, OPTOCPLR, DUAL, LOGIC	3
515094	FUSE WITH FUSEHOLDER, 3A	2
213413	CONN, 40 PIN, HEADER	2
484575	VOLT RGLTR, 1.2V-37V, 3A	1

Part No.	Description	Quantity
487146	IC, OPTOCOUPLER, 4-CH, 16	2
211411	CONNECTOR, PLUG, 4 PIN	1
474303	RESISTOR, 4.3 OHM, .75W	1
2764-02	FAB, POWER BOARD	1
481552	DIODE, MBRS340T3, SCHOTTKY	6
211924	CONN, 9 PIN, RCPT, D-SUB	3
474220	RESISTOR, ZERO OHM, 1/4W	1
474228	RESISTOR, 1.21K OHM, 1/16	1
472075	RESISTOR, 1M OHM, 1/4W	1
472030	RESISTOR, 10K OHM, 1/4W	1
152065	CAPACITOR, 10UF, 20%, 25V	2
484576	VOLT RGLTR	1
606402	WIRE, BUS, 26AWG	0
608022	TEFLON TUBING	0
474172	RESISTOR, 10 OHM, 1/8W	1
474260	RESISTOR, 121K OHM, 1/16W	2
606812	WIRE, 30AWG, SOLID, PVC 1	0
9330-01	WIRE ASSY	1
474229	RESISTOR, 2.05K OHM, 1/16	4
481547	DIODE, BAT54, HOT CARRIER	6
474245	RESISTOR, IM OHM, 1/16W	5
474245	RESISTOR, IM OHM, 1/16W	6
474233	RESISTOR, 10K OHM, 1/16W	30
474233	RESISTOR, 10K OHM, 1/16W	29
474222	RESISTOR, 10 OHM, 1/16W	5
474222	RESISTOR, 10 OHM, 1/16W	6
180030	INDUCTOR-CAP, 4700PF, 50V	4
180030	INDUCTOR-CAP, 4700PF, 50V	5
474227	RESISTOR, 1K OHM, 1/16W	27
474227	RESISTOR, 1K OHM, 1/16W	30
154105	CAPACITOR, 47PF, SOVOC	4
154105	CAPACITOR, 47PF, SOVOC	3
154103	CAPACITOR, .001UF, 50VDC	3
154103	CAPACITOR, .001UF, SOVOC	4
154112	CAPACITOR, .047UF, 16VDC	11
154112	CAPACITOR, .047UF, I6VDC	10
474230	RESISTOR, 3.32K OHM, 1/16	2
474230	RESISTOR, 3.32K OHM, 1/16	1
474224	RESISTOR, 100 OHM, 1/16W	10
474224	RESISTOR, 100 OHM, 1/16W	13
154104	CAPACITOR, .01UF, 50VDC	48
154104	CAPACITOR, .01UF, 50VDC	49
154079	CAPACITOR, lOUF, 25V, 10%	4
154079	CAPACITOR, lOUF, 25V, 10%	6

Part No.	Description	Quantity
474198	RESISTOR, 2.49K OHM, 1/16	4
474198	RESISTOR, 2.49K OHM, 1/16	5
474231	RESISTOR, 4.99K OHM, 1/16	1
474231	RESISTOR, 4.99K OHM, 1/16	2

10.5 2765-01 Analog Board Assy

Part No.	Description	Quantity
475051	POTENTIOMETER, 10K OHM	4
474245	RESISTOR, iM OHM, 1/16W	7
474241	RESISTOR, 150K OHM, 1/16W	9
154111	cAPACITOR, .1UF, l6VDC	8
486825	IC, LMC710lBIM5X, OP AMP	1
484544	VOLTAGE REGULATOR, MC79L12	1
487129	IC, CPCl5AFH, ABSOLUTE PR	1
180034	FERRITE FILTER, 4 LIN, EM	1
474222	RESISTOR, 10 OHM, 1/16W	20
152096	cAPACITOR, 220UF, 35V, 20	5
486790	IC, TLE2022CD, DUAL OP AM	4
486340	IC, TLC2543CDW, 12 BIT A	1
487115	IC, INSTR AMP, LOW POWER	4
474242	RESISTOR, 249K OHM, 1/16W	5
475042	POTENTIOMETER, 50K OHM	1
474265	RESISTOR, 1 OHM, 1/4W, 1%	1
481555	DIODE, MMBD7000LT1, DUAL	25
474227	RESISTOR, 1K OHM, 1/16W	24
474229	RESISTOR, 2.05K OHM, 1/16	1
474238	RESISTOR, 37.4K OHM, 1/16	1
474259	RESISTOR, 15K OHM, 1/16W	4
250146	VALVE, SOLENOID, 5V	4
486829	IC, bTC1590CS, DUAL 12-BI	1
484542	VOLTAGE REGULATOR	1
474228	RESISTOR, 1.21K OHM, 1/16	1
486796	IC, TLC2272CD, DUAL OP AM	4
487124	IC, ERT-3281, REFLECTIVE	4
486785	IC, LP339M, QUAD VOLTAGE	2
212501	CONNECTOR, 20 PIN, HEADER	1
486324	IC, DG444DY, QUAD SPST CM	1
474261	RESISTOR, 7.5K OHM, 1/16W	3
474251	RESISTOR, 61.9K OHM, 1/16	1
154086	cAPACITOR, 4.7UF, l0VDC	2
481546	DIODE, SWITCHING, SURF MT	1
481547	DIODE, BAT54, HOT CARRIER	5

Part No.	Description	Quantity
474194	RESISTOR, 2.2M OHM, 1/16W	2
180035	FERRITE FILTER, 8 LINE	2
484543	VOLTAGE REGULATOR	1
486821	IC, AD822AR, FET-IN OP AMP	4
486807	IC, SMP04ES, QUAD SAMPLE	1
474230	RESISTOR, 3.32K OHM, 1/16	2
481556	DIODE, MMBD354LT1, DUAL	2
474239	RESISTOR, 75K OHM, 1/16W	8
486332	IC, AD7703BR, 20-BIT A TO	2
474198	RESISTOR, 2.49K OHM, 1/16	2
154108	cAPACITOR, 100PF, 50VDC	2
486481	IC, TLC5620CD, QUAD 8-B D	1
250151	VALVE, SOLENOID, 5V	2
211213	CONNECTOR, 2 PIN	1
474224	RESISTOR, 100 OHM, 1/16W	28
474223	RESISTOR, 49.9 OHM, 1/16W	8
481548	DIODE, EGL4lB, RECTIFIER	3
154079	CAPACITOR, lOUF, 25V, 10%	11
216029	TEST POINT, SPRING LOADED	16
154116	cAPACITOR, lOUF, 35V, 10%	7
474234	RESISTOR, 20.5K OHM, 1/16	2
211327	CONNECTOR, 3 PIN, HEADER	1
474225	RESISTOR, 499 OHM, 1/16W	4
474195	RESISTORs 511K OHM, 1/16W	1
485532	TRANSISTOR, 2N7002T1	3
487078	IC, AD7121R, DUAL BIFET 0	2
474236	RESISTOR, 33.2K OHM, 1/16	2
474235	RESISTOR, 24.9K OHM, 1/16	8
487136	IC, PRESSURE XDCR, 0-5 PS	1
487137	IC, PRESSURE SENSOR, 1 IN	1
486832	IC, PRECISION 5V REF, LOW	1
486831	IC, PRECISION 2.5V REF	1
486362	IC, 20 BIT A TO D CONV	1
474316	RES PACK, 100K OHM, 3/4W	1
474310	RES PACK, 10K OHM, .1W	1
486833	IC, 4-INPUT & OUTPUT OP	1
2765-02	FAB, ANALOG BOARD	1
213414	CONN, 40 PIN, HDR, ELEV	2
9270-16	FL CONN, RCPT, 3 PT, 7300	1
9272-16	SEAL FL CONN, 7300 - NICO	1
9328-16	SUPPORT, XDUCER	2
9269-01	SPO2 CONN BRKT ASSY, 7300	1
484545	VOLTAGE REGULATOR, MC78L1	2
474157	RESISTOR, 511 OHM, 1/8W	4

Part No.	Description	Quantity
486042	IC, AT93C66-l0SC, SERIAL	1
474175	RESISTOR, 3.92K OHM, 1/8W	2
486805	IC, LM393M, DUAL VOLTAGE	1
154137	CAPACITOR, .0047uF, 50VDC	2
154138	CAPACITOR, .001uF, 50V	6
154139	CAPACITOR, .047uF, 5%	1
281211	SCREW, 2-56 X 1/4L, SELF	0
284008	SCR, 4-24 X 5/16L, PAN HD	0
484010	NPN TRANSISTOR 2N3904	2
483002	2N3906 PNP SILICON SWITCH	1
472058	RESISTOR, 100K OHM, 1/4W	1
474243	RESISTOR, 324K OHM, 1/16W	2
474271	RESISTOR, 402 OHM, 1/16W	1
486314	IC, MC74~C541DW, OCTAL BU	1
483019	TRANSISTOR, MMBT2907ALT1	1
485543	TRANSISTOR, MOSFET, N-CHA	1
486366	IC, DIGITAL POT, 10K OHM	1
154143	CAPACITOR, .01uF, 50VDC	6
484540	VOLTAGE REGULATOR, LP2951	1
250164	FITTING, PRESS-IN PLUG	1
608129	TUBING, ESTER-BASED POLY	0
250134	FITTING, Y, FOR 1/16 ID T	2
9024-10	PNEUMATIC JUNCTION BOX	2
250109	FITTING, TEE, FOR 1/16 ID	2
160030	TUBING, .062 ID X .125 OD	0
250169	FILTER, INLINE, 25 MICRON	4
250171	CHECK VALVE, NC, .7 OD	2
608022	TEFLON TUBING	0
606407	WIRE, 30AWG, SOLTD, UNINS	0
606812	WIRE, 30AWG, SOLID, PVC	0
154072	CAPACITOR, .1UF, 50V, 10%	15
154072	CAPACITOR, .1UF, 50v, 10%	14
154103	CAPACITOR, .001UF, 50VDC	3
154103	CAPACITOR, .001UF, 50VDC	9
154104	CAPACITOR, .01UF, 50vDC	76
154104	CAPACITOR, .0lUF, 50vDC	73
154105	CAPACITOR, 47PF, 50vDC	4
154105	CAPACITOR, 47P~, 50VDC	6
154106	CAPACITOR, 22PF, 50VDC	8
154106	CAPACITOR, 22PF, 50VDC	4
154112	CAPACITOR, .047UF, 16VDC	38
154112	CAPACITOR, .047UF, l6VDC	42
180030	INDUCTOR-CAP, 4700PF, 50V	4
180030	INDUCTOR-CAP, 4700PF, 50V	5

Part No.	Description	Quantity
180056	FERRITE BEAD, 120 OHMS	6
180056	FERRITE BEAD, 120 OHMS	4
474197	RESISTOR, 49.9K OHM, 1/16	12
474197	RESISTOR, 49.9K OHM, 1/16	18
474233	RESISTOR, 10K OHM, 1/16w	18
474233	RESISTOR, 10K OHM, 1/16w	19
474240	RESISTOR, 100K OHM, 1/16w	42
474240	RESISTOR, 100K OHM, 1/16w	44
474256	RESISTOR, 0 OHM, 0603 STY	6
474256	RESISTOR, 0 OHM, 0603 STY	5
484061	TRANSISTOR, MMBT2222ALTI	1
484061	TRANSISTOR, MMBT2222ALTI	2
485540	TRANSISTOR, MOSFET, DUAL	4
485540	TRANSISTOR, MOSFET, DUAL	3

10.6 2766-01 CO_2 Input Board Assy

Part No.	Description	Quantity
2766-02	FAB, CO2 INPUT BOARD	1
2766-03	SCHEMATIC, CO2 INPUT BD	0
600055	RIBBON CABLE ASSY, 20 PIN	1
212527	CONNECTOR, 20 PIN, RECEPT	1

10.7 9392-01 Pump W Rsvr Assy

Item	Part No.	Description	Quantity
001	9322-01	RESERVOIR ASSY	1
002	9397-10	MOUNTING PL, PUMP, 7300	1
006	161108	FOAM TAPE, 1/32THK x 3/4W	0
007	211328	CONNECTOR, 3 PIN, RCPT	1
008	250130	PUMP, DIAPHRAGM, 4.5V	1
009	250169	FILTER, INLINE, 25 MICRON	1
010	280192	GROMMET, RIBBED, ISODAMP	2
011	284009	5CR, 4-24 X 1/4L, PAN HD	0
012	605001	WIRE, 28AWG, RED, TINNED	0
013	605007	WIRE, 28AWG, BLACK, TINNED	0
014	608001	CABLE TIE, .094 X 3.62L	0
015	608005	TUBING, HEAT SHRINK, 1/16	0
016	608012	CABLE TIE, SELF-LKG, .094	1
017	608114	TUBING, TYGON, 3/32 IN	0

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11 Drawings

Number	Title
9226-00	Non-Invasive Cardiac Output Monitor, 7300
9226-09	Overall Wiring Diagram
9226-01	Main Assembly, Model 7300 - NICO (5 sheets)
2763-01	Digital Board Assy, Model 7300 - NICO (3 sheets)
2763-03	Schematic, Digital Bd, Model 7300, NICO (3 sheets)
2764-01	Power Board Assy, Model 7300 - NICO (3 sheets)
2764-03	Schematic, Power Board, Model 7300, NICO (6 sheets)
2765-01	Analog Board Assy, Model 7300 - NICO (4 sheets)
2765-03	Schematic, Analog Board, Model 7300, NICO (5 sheets)
2766-01	CO_2 Input Board Assy, Model 7300 - NICO
2766-03	Schematic, CO_2 Input Board

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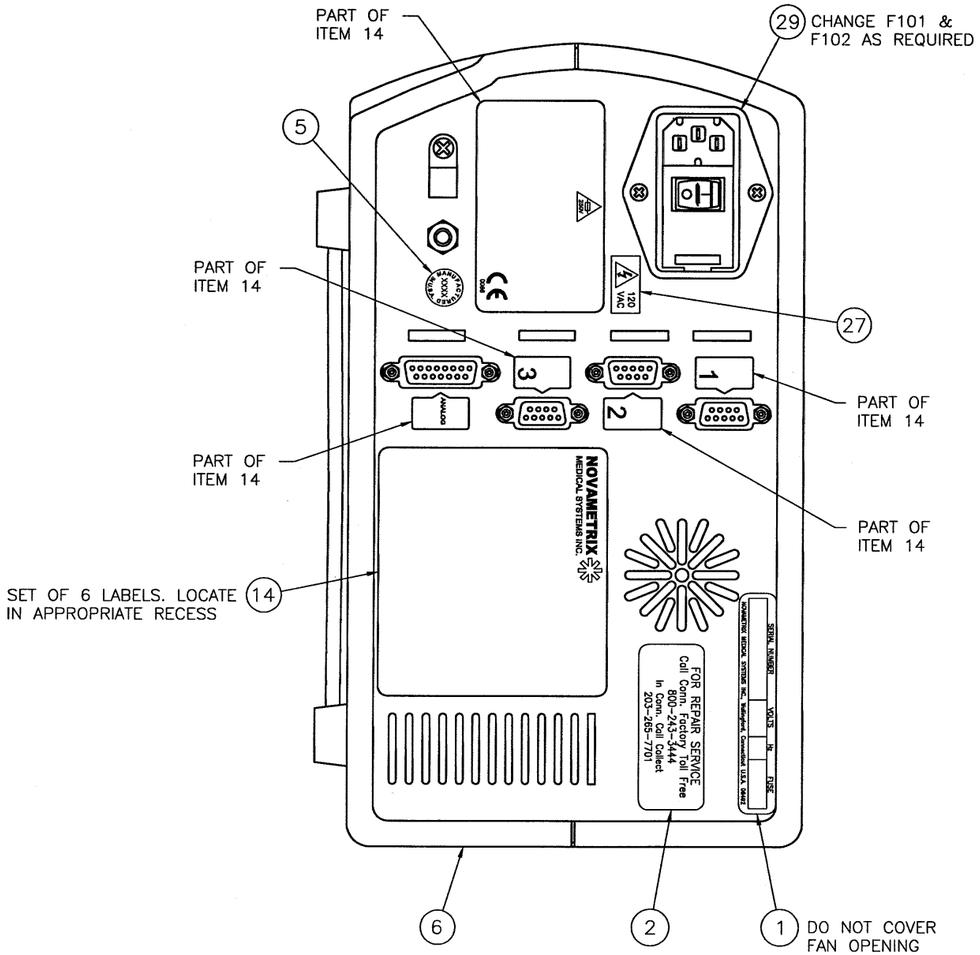

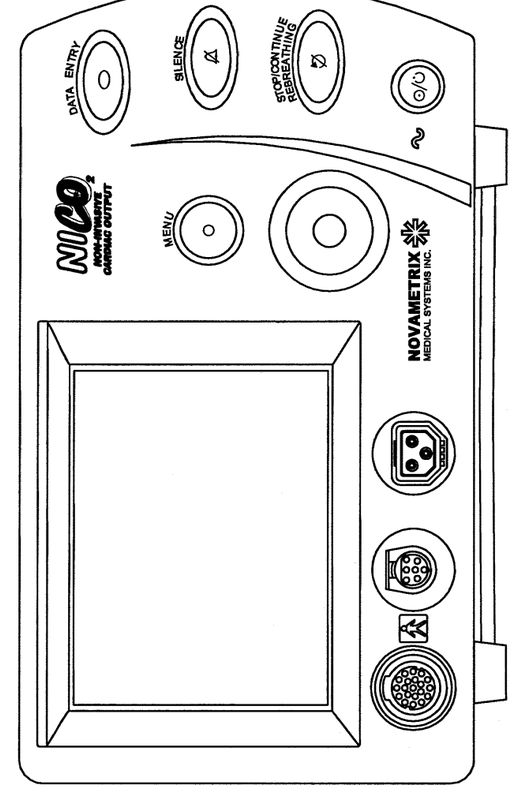

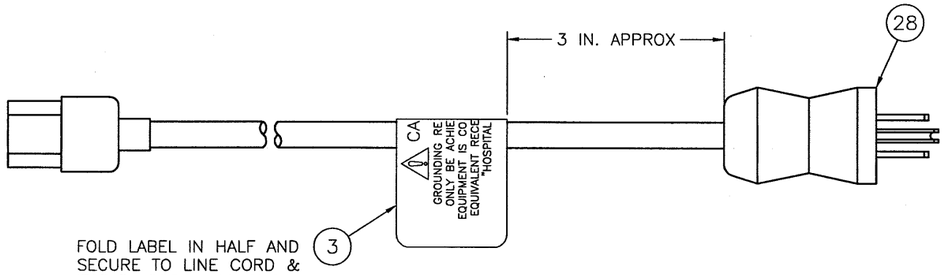

NOTES:

1. D9226–00 MONITOR SHOWN FOR REFERENCE ONLY.
2. FOR QA INSPECTION PROCEDURE SEE A9226–70.
3. FOR OVERALL WIRING DIAGRAM SEE D9226–09.
4. WIPE UNIT & LINE CORD CLEAN WITH IPA, ITEM 26 BEFORE APPLYING LABELS.
5. LOCATE LABELS APPROX AS SHOWN NOTING ORIENTATION.

DRAWING TABULATION		
DWG NO.	REV	TITLE
D9226–00	01 N660	NON–INVASIVE CARDIAC OUTPUT MONITOR
D9226A–00	01 N660	NON–INVASIVE CARDIAC OUTPUT MONITOR, FRE
D9226B–00	01 N660	NON–INVASIVE CARDIAC OUTPUT MONITOR, ITA
D9226C–00	01 N660	NON–INVASIVE CARDIAC OUTPUT MONITOR, GER
D9226D–00	01 N660	NON–INVASIVE CARDIAC OUTPUT MONITOR, SPA

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REV	R NO.	DATE
01	N660	9Apr99

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [mm]
TOLERANCES
.XX ±.01 [.254]
.XXX ±.005 [.127]
.XXXX ±.0025 [.064]
FRAC ±1/64
ANG ±1/4°

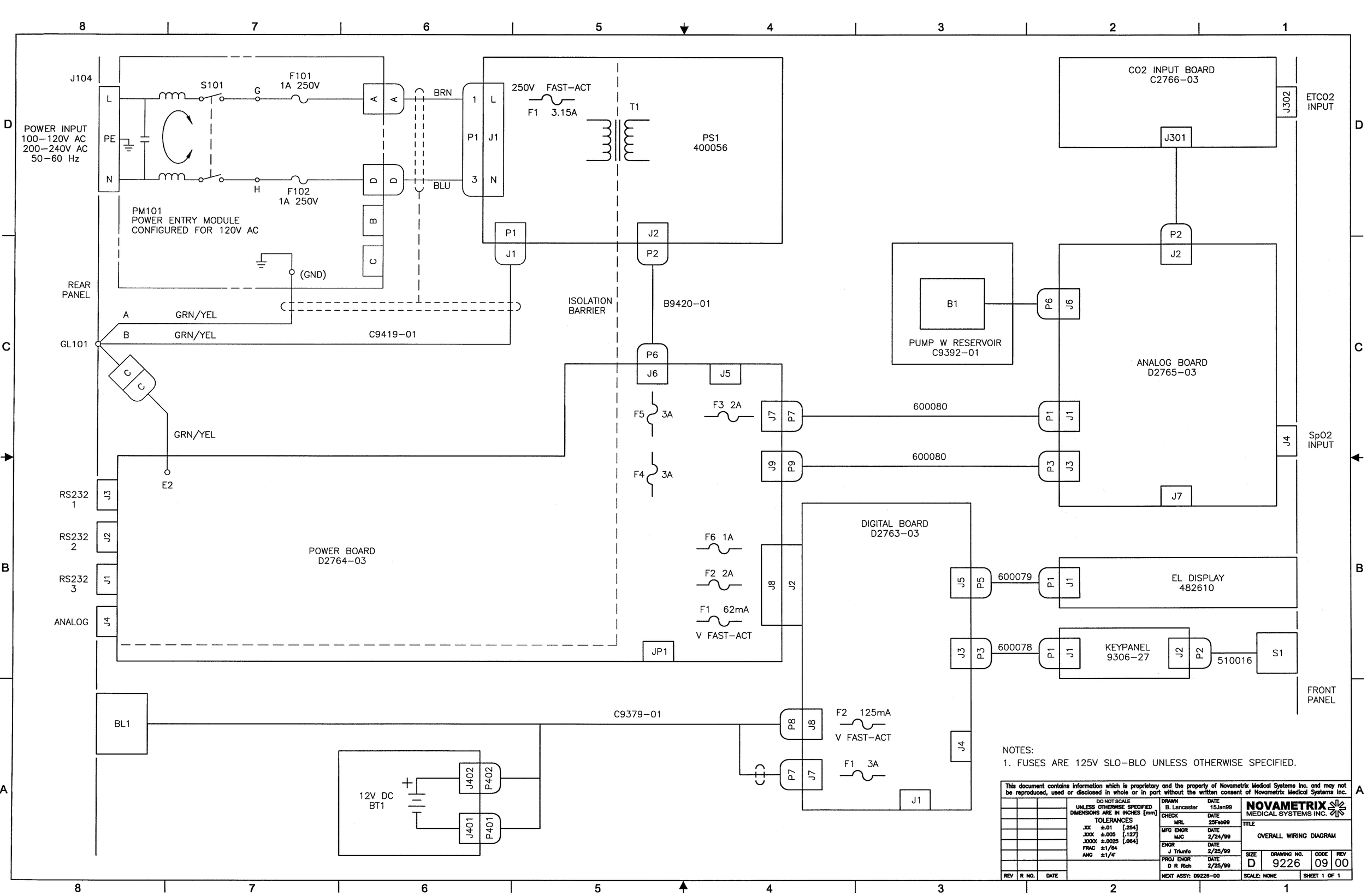
DRAWN	Bob Lancaster	DATE 28Dec98
CHECK	MR.	DATE 25Feb99
MFG ENGR	BN	DATE 25Feb99
ENGR	J Triunfo	DATE 25Feb99
PROJ ENGR	D R Rich	DATE 2/25/99
NEXT ASSY: ~		

NOVAMETRIX MEDICAL SYSTEMS INC.

TITLE: NON–INVASIVE CARDIAC OUTPUT MONITOR, 7300

SIZE	DRAWING NO.	CODE	REV SEE TAB
D	9226	00	

SCALE: 1/1 SHEET 1 OF 1



NOTES:

1. FUSES ARE 125V SLO–BLO UNLESS OTHERWISE SPECIFIED.

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TOLERANCES
.XX ±.01 [.254]
.XXX ±.005 [.127]
.XXXX ±.0025 [.064]
FRAC ±1/64
ANG ±1/4°

REV	R NO.	DATE

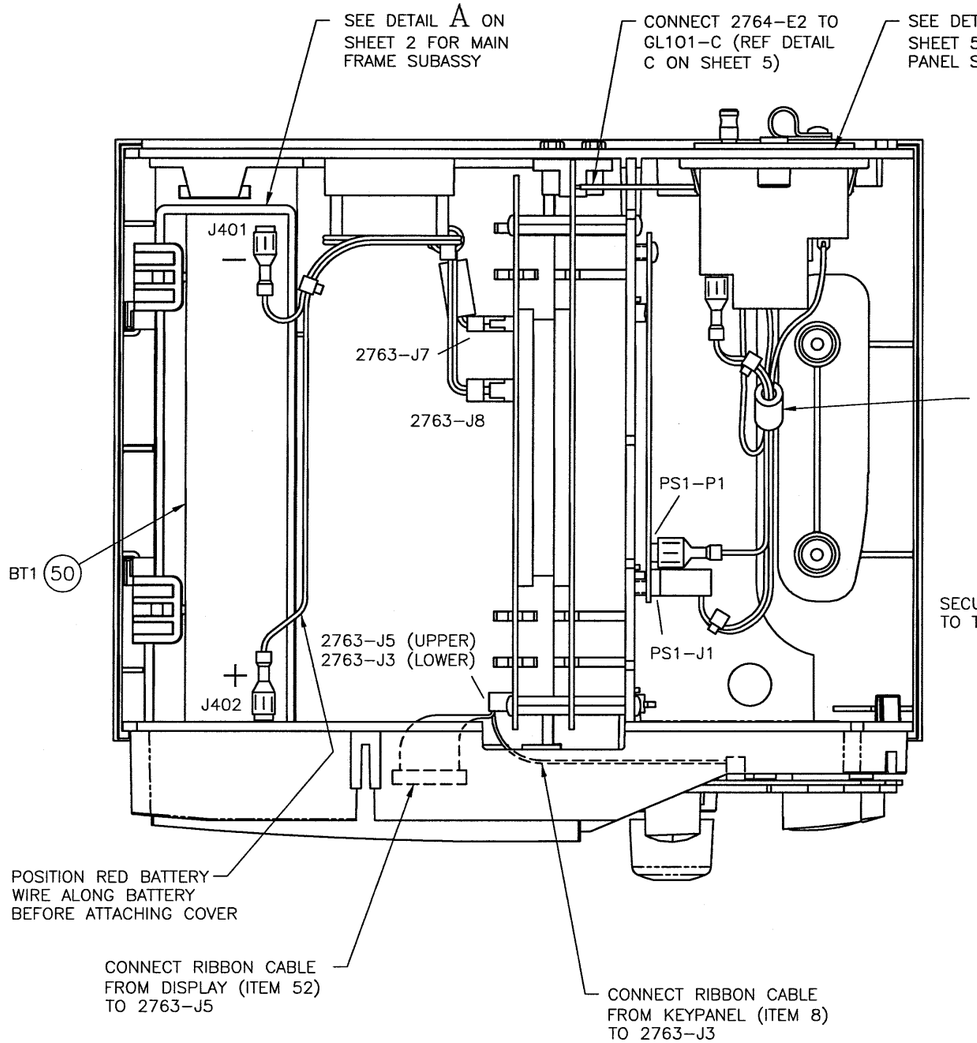
DRAWN	B. Lancaster	DATE 15Jan99
CHECK	MRL	DATE 25Feb99
MFG ENGR	MJC	DATE 2/24/99
ENGR	J Triunfo	DATE 2/25/99
PROJ ENGR	D R Rich	DATE 2/25/99
NEXT ASSY: D9226–00		

NOVAMETRIX
MEDICAL SYSTEMS INC.

TITLE: OVERALL WIRING DIAGRAM

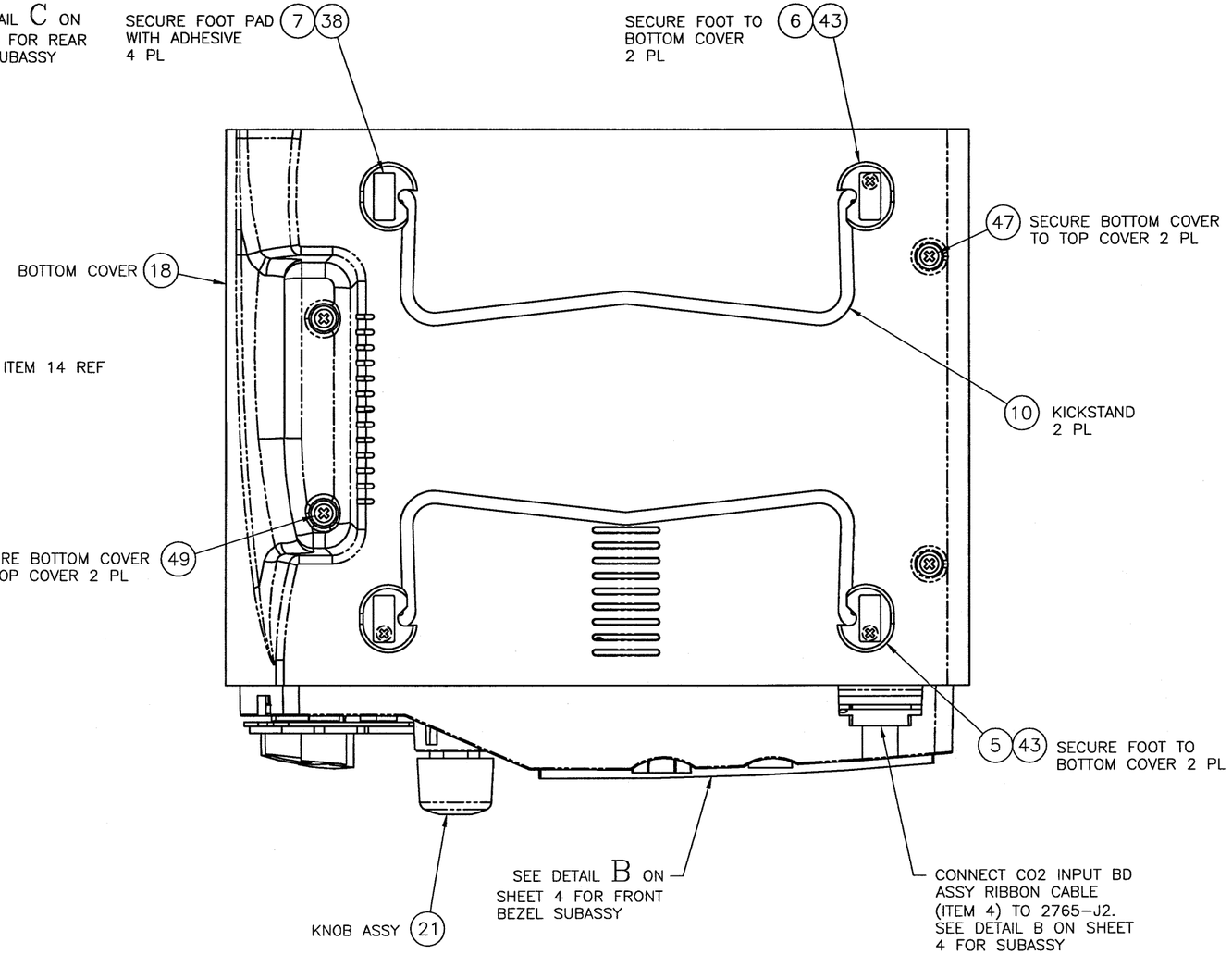
SIZE	DRAWING NO.	CODE	REV
D	9226	09	00

SCALE: NONE SHEET 1 OF 1


SEE DETAIL A ON SHEET 2 FOR MAIN FRAME SUBASSY
CONNECT 2764-E2 TO GL101-C (REF DETAIL C ON SHEET 5)
SEE DETAIL C ON SHEET 5 FOR REAR PANEL SUBASSY
J401
2763-J7
2763-J8
ITEM 14 REF
PS1-P1
PS1-J1
BT1 50
2763-J5 (UPPER)
2763-J3 (LOWER)
J402
POSITION RED BATTERY WIRE ALONG BATTERY BEFORE ATTACHING COVER
CONNECT RIBBON CABLE FROM DISPLAY (ITEM 52) TO 2763-J5
CONNECT RIBBON CABLE FROM KEYPANEL (ITEM 8) TO 2763-J3

TOP VIEW

NOTE: TOP COVER, ITEM 17, REMOVED FOR CLARITY


SECURE FOOT PAD 7 38 WITH ADHESIVE 4 PL
SECURE FOOT TO BOTTOM COVER 6 43 2 PL
47 SECURE BOTTOM COVER TO TOP COVER 2 PL
BOTTOM COVER 18
10 KICKSTAND 2 PL
SECURE BOTTOM COVER 49 TO TOP COVER 2 PL
5 43 SECURE FOOT TO BOTTOM COVER 2 PL
SEE DETAIL B ON SHEET 4 FOR FRONT BEZEL SUBASSY
CONNECT CO2 INPUT BD ASSY RIBBON CABLE (ITEM 4) TO 2765-J2. SEE DETAIL B ON SHEET 4 FOR SUBASSY
KNOB ASSY 21

BOTTOM VIEW

NOTES:
1. FOR SYSTEM TEST PROCEDURE SEE A9226-04.
2. FOR OVERALL WIRING DIAGRAM SEE D9226-09.

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REV	R NO.	DATE

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TOLERANCES
.XX ±.01 [.254]
.XXX ±.005 [.127]
.XXXX ±.0025 [.064]
FRAC ±1/64
ANG ±1/4°

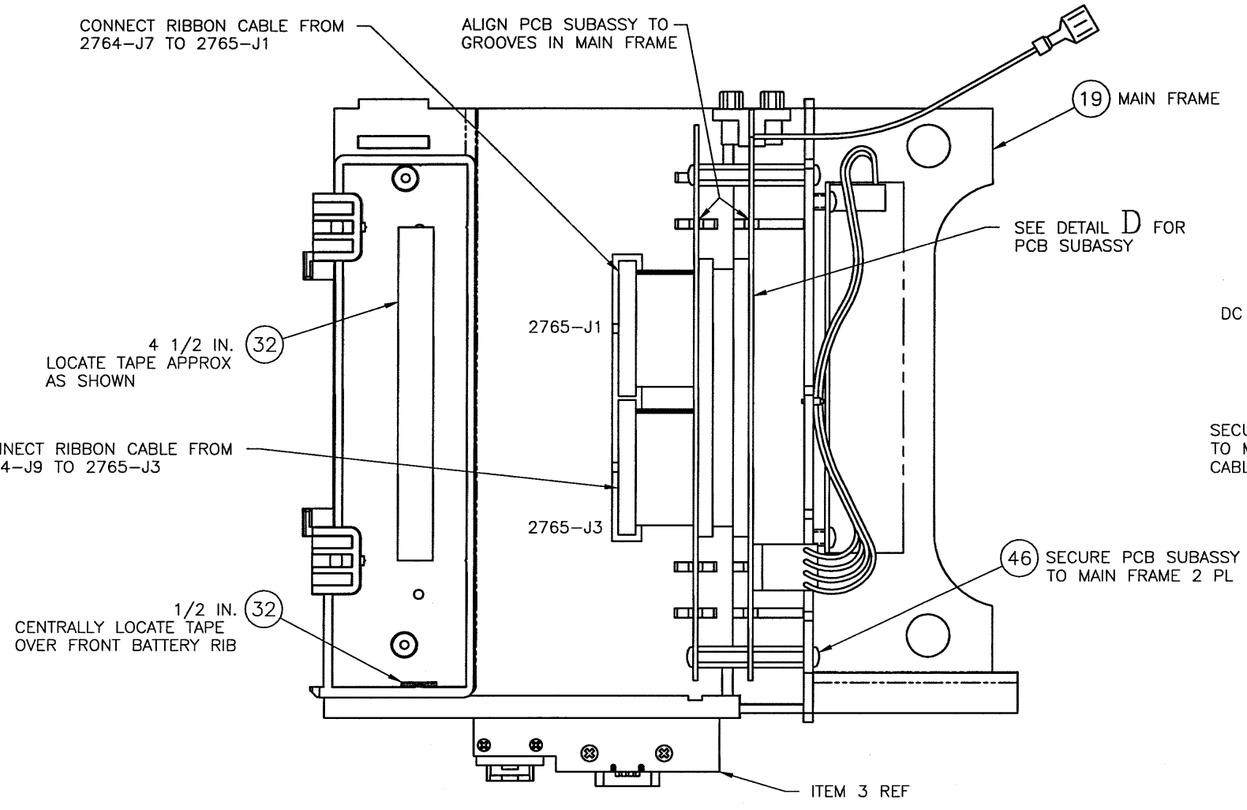
DRAWN Bob Lancaster	DATE 28Dec98
CHECK MRL	DATE 19Feb99
MFG ENGR BN	DATE 18Feb99
ENGR J SANDOR	DATE 19Feb99
PROJ ENGR DRR	DATE 2/18/99
NEXT ASSY: D9226-00	

NOVAMETRIX MEDICAL SYSTEMS INC.

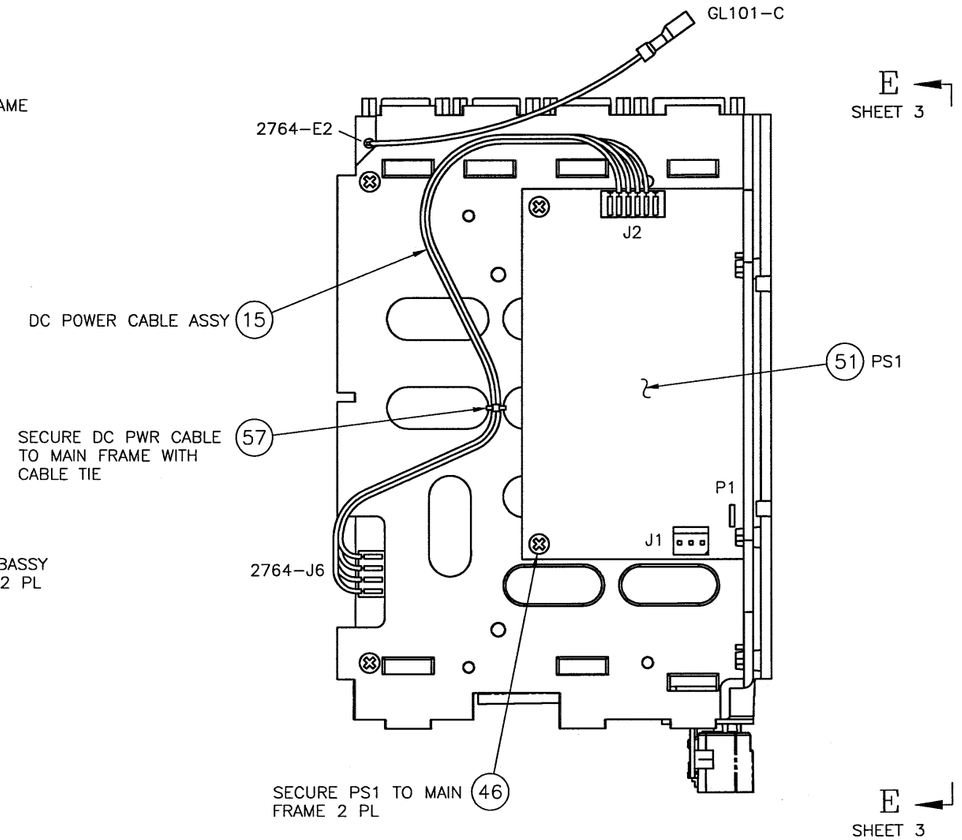
TITLE: MAIN ASSEMBLY, MODEL 7300 – NICO

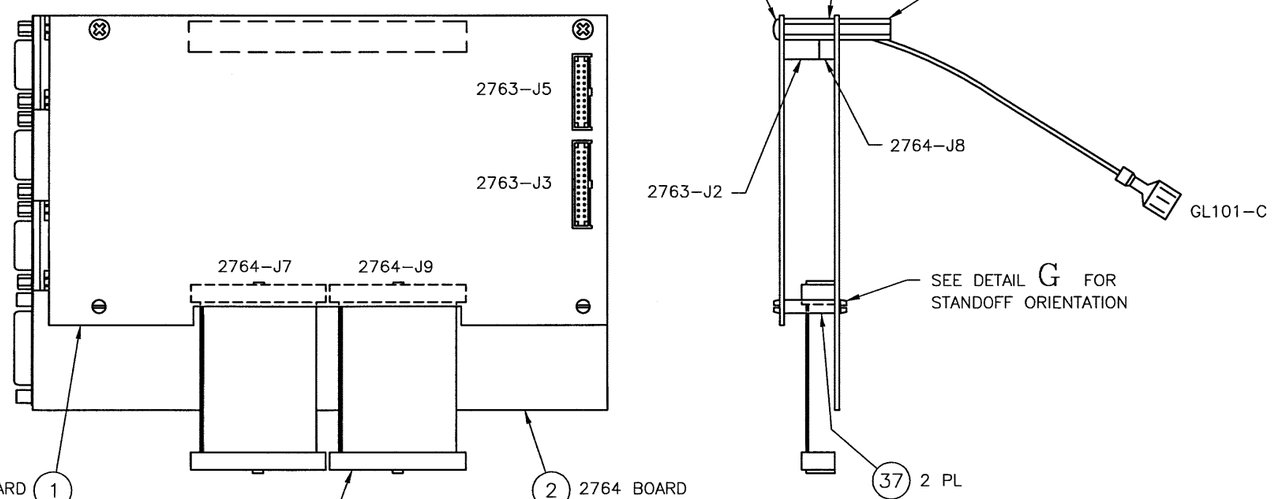
SIZE	DRAWING NO.	CODE	REV
D	9226	01	00

SCALE: 1/1 SHEET 1 OF 5

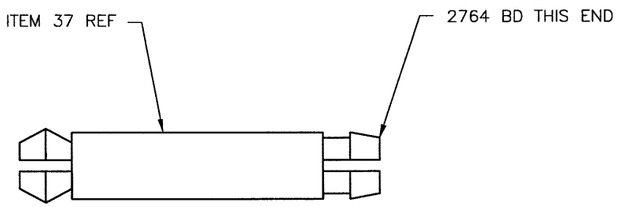

CONNECT RIBBON CABLE FROM 2764–J7 TO 2765–J1
ALIGN PCB SUBASSY TO GROOVES IN MAIN FRAME
19 MAIN FRAME
SEE DETAIL D FOR PCB SUBASSY
4 1/2 IN. LOCATE TAPE APPROX AS SHOWN
32
2765–J1
CONNECT RIBBON CABLE FROM 2764–J9 TO 2765–J3
2765–J3
46 SECURE PCB SUBASSY TO MAIN FRAME 2 PL
1/2 IN. CENTRALLY LOCATE TAPE OVER FRONT BATTERY RIB
32
ITEM 3 REF

DETAIL A





DETAIL D



DETAIL G

SCALE: 5/1

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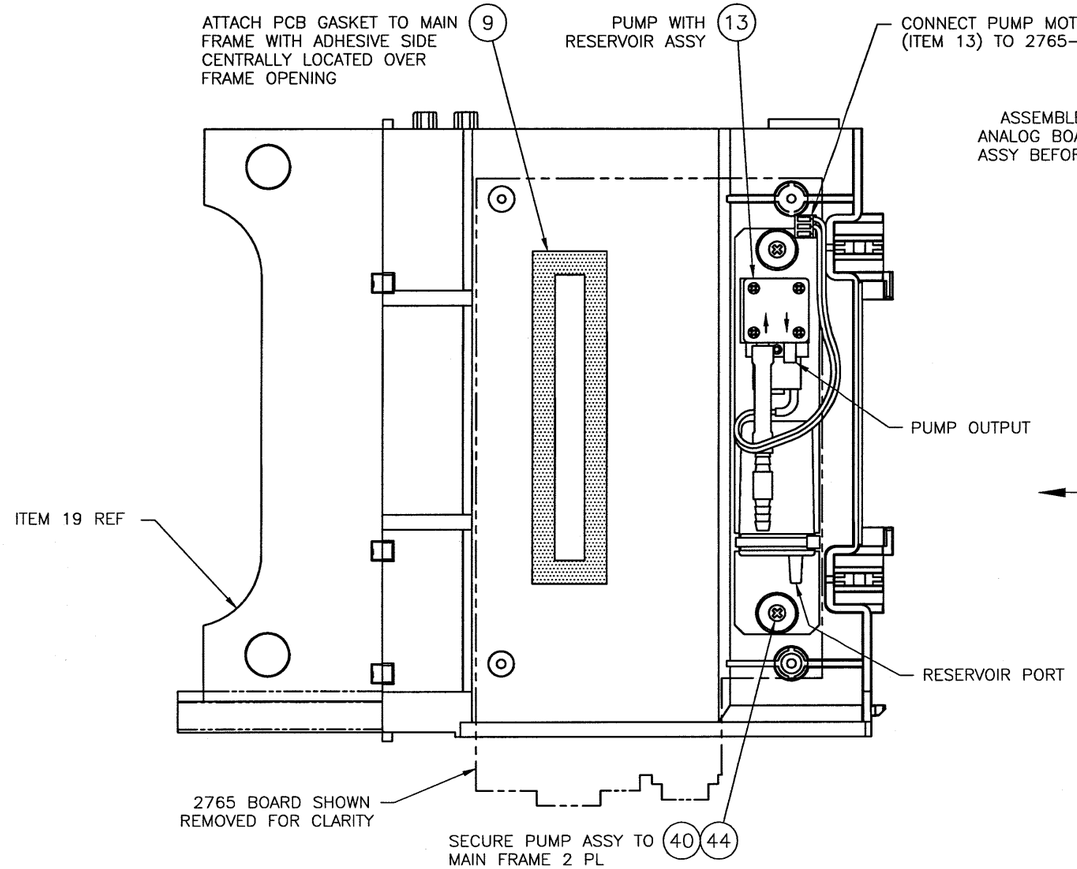
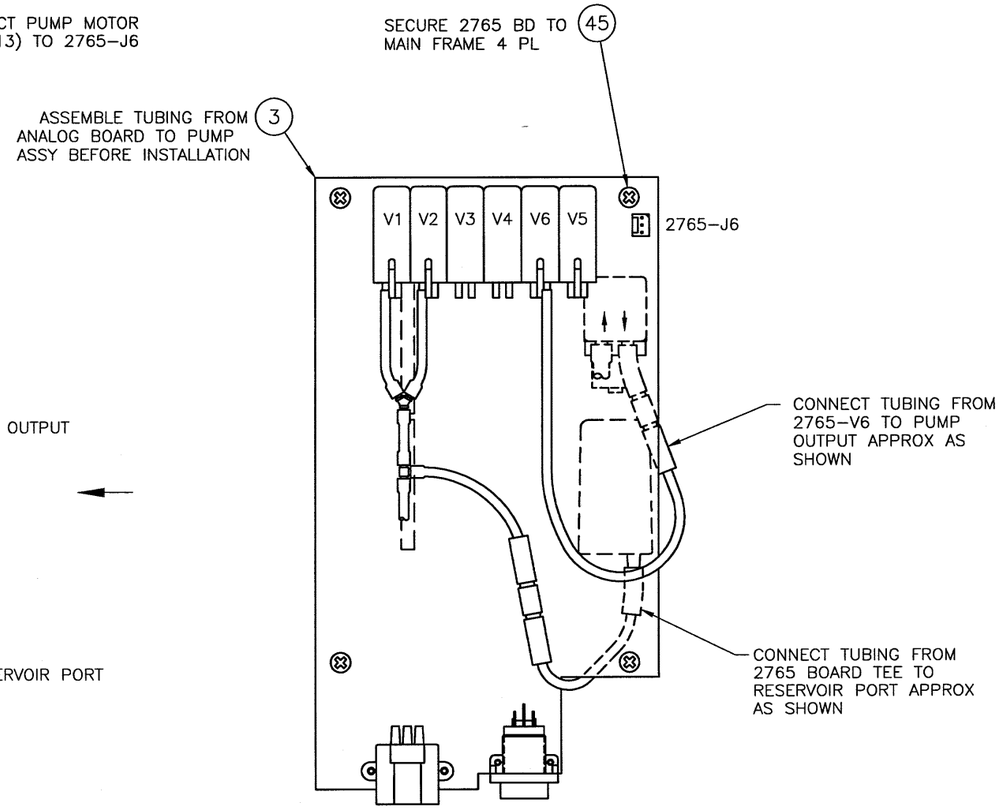
REV	R NO.	DATE	DO NOT SCALE UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [mm] TOLERANCES JX ±.01 [.254] JXX ±.005 [.127] JXXX ±.0025 [.064] FRAC ±1/16 ANG ±1/4°	DRAWN B. Lancaster DATE 31Dec98	NOVAMETRIX MEDICAL SYSTEMS INC.		
				CHECK MRL DATE 19Feb99	TITLE MAIN ASSEMBLY, MODEL 7300 – NICO		
				MFG ENGR BN DATE 18Feb99			
				ENGR J SANDOR DATE 19Feb99	SIZE D	DRAWING NO. 9226	CODE 01 REV 00
				PROJ ENGR DRR DATE 2/18/99			
				NEXT ASSY: D9226–00	SCALE: 1/1		SHEET 2 OF 5


ATTACH PCB GASKET TO MAIN FRAME WITH ADHESIVE SIDE CENTRALLY LOCATED OVER FRAME OPENING
9
PUMP WITH RESERVOIR ASSY
13
CONNECT PUMP MOTOR (ITEM 13) TO 2765–J6
PUMP OUTPUT
ITEM 19 REF
RESERVOIR PORT
2765 BOARD SHOWN REMOVED FOR CLARITY
SECURE PUMP ASSY TO MAIN FRAME 2 PL
40
44



VIEW E–E

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REV	R NO.	DATE	DESCRIPTION
			DO NOT SCALE UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [mm]
			TOLERANCES
			.XX ±.01 [.254]
			.XXX ±.005 [.127]
			.XXXX ±.0025 [.064]
			FRAC ±1/64
			ANG ±1/4°

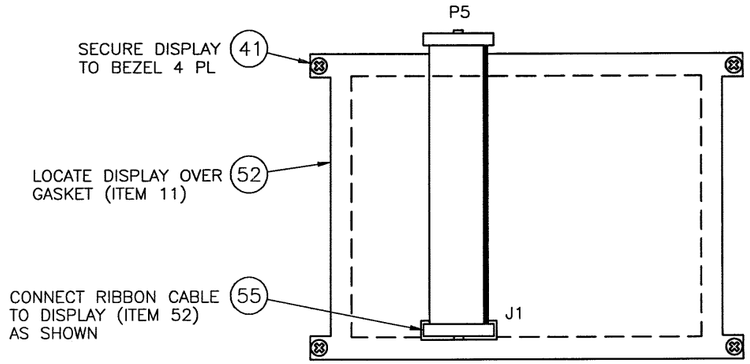
DRAWN	B. Lancaster	31Dec98
CHECK	MRL	19Feb99
MFG ENGR	BN	18Feb99
ENGR	J SANDOR	19Feb99
PROJ ENGR	DRR	2/18/99

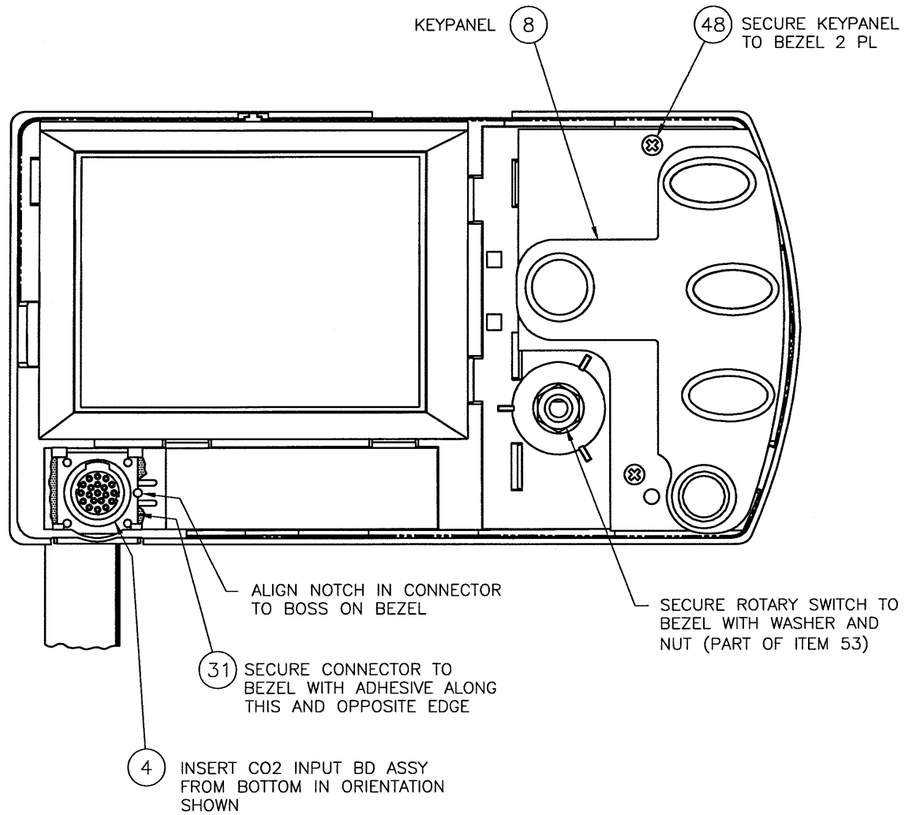
NOVAMETRIX MEDICAL SYSTEMS INC.

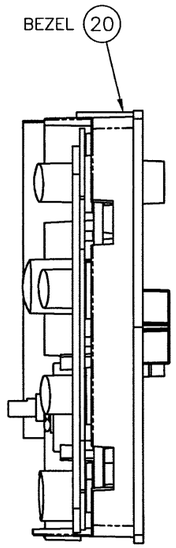
TITLE: MAIN ASSEMBLY, MODEL 7300 – NICO

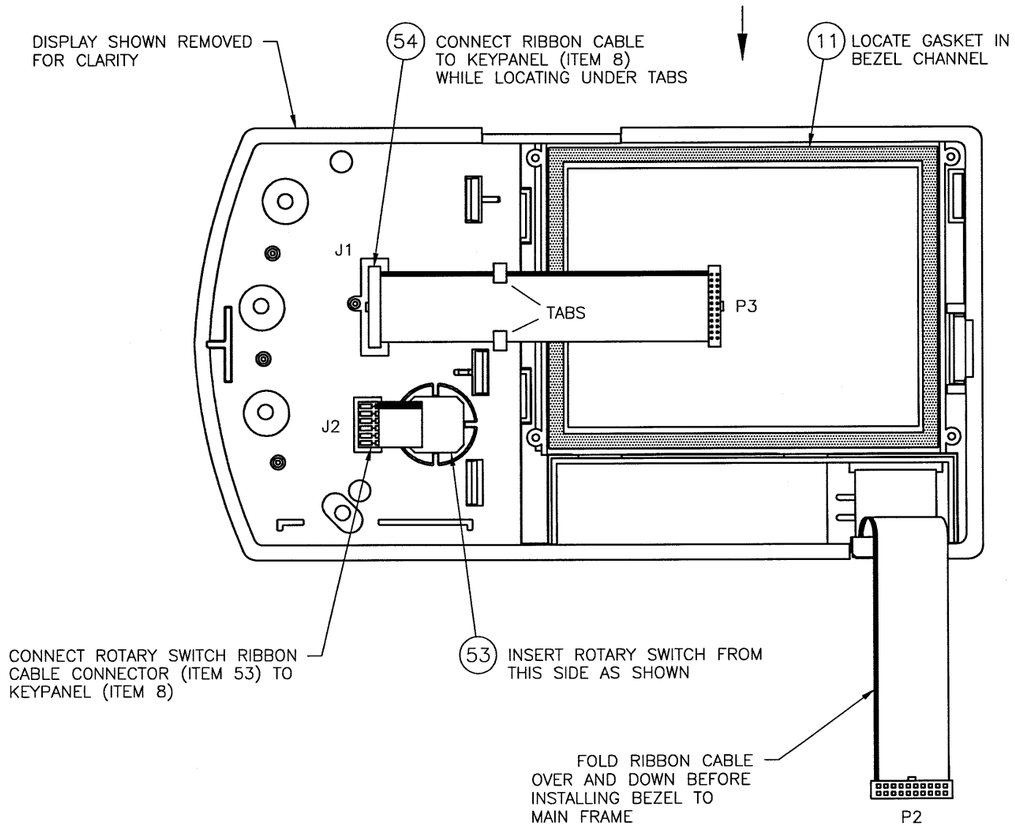
SIZE	DRAWING NO.	CODE	REV
D	9226	01	00

NEXT ASSY: D9226–00 | SCALE: 1/1 | SHEET 3 OF 5


P5
SECURE DISPLAY (41) TO BEZEL 4 PL
LOCATE DISPLAY OVER (52) GASKET (ITEM 11)
CONNECT RIBBON CABLE (55) TO DISPLAY (ITEM 52) AS SHOWN
J1


KEYPANEL (8)
(48) SECURE KEYPANEL TO BEZEL 2 PL
ALIGN NOTCH IN CONNECTOR TO BOSS ON BEZEL
SECURE ROTARY SWITCH TO BEZEL WITH WASHER AND NUT (PART OF ITEM 53)
(31) SECURE CONNECTOR TO BEZEL WITH ADHESIVE ALONG THIS AND OPPOSITE EDGE
(4) INSERT CO2 INPUT BD ASSY FROM BOTTOM IN ORIENTATION SHOWN




DISPLAY SHOWN REMOVED FOR CLARITY
(54) CONNECT RIBBON CABLE TO KEYPANEL (ITEM 8) WHILE LOCATING UNDER TABS
(11) LOCATE GASKET IN BEZEL CHANNEL
J1
TABS
P3
J2
CONNECT ROTARY SWITCH RIBBON CABLE CONNECTOR (ITEM 53) TO KEYPANEL (ITEM 8)
(53) INSERT ROTARY SWITCH FROM THIS SIDE AS SHOWN
FOLD RIBBON CABLE OVER AND DOWN BEFORE INSTALLING BEZEL TO MAIN FRAME
P2

DETAIL B

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TOLERANCES
.XX ±.01 [.254]
.XXX ±.005 [.127]
.XXXX ±.0025 [.064]
FRAC ±1/64
ANG ±1/4°

REV	R NO.	DATE

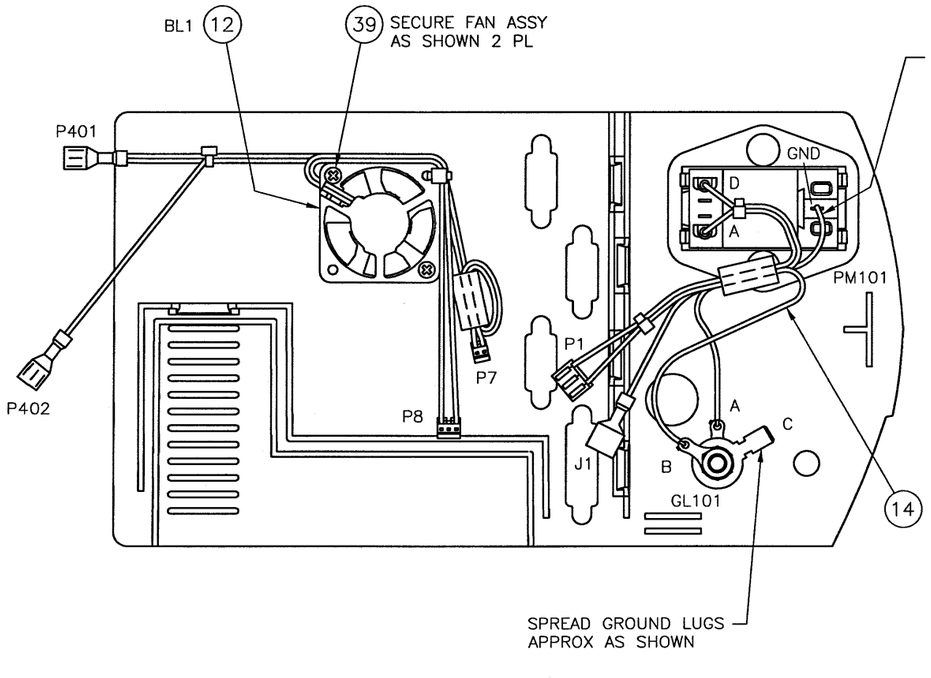
	DATE
DRAWN B. Lancaster	31Dec98
CHECK MRL	19Feb99
MFG ENGR BN	18Feb99
ENGR J SANDOR	19Feb99
PROJ ENGR DRR	2/18/99
NEXT ASSY: D9226-00	

NOVAMETRIX MEDICAL SYSTEMS INC.

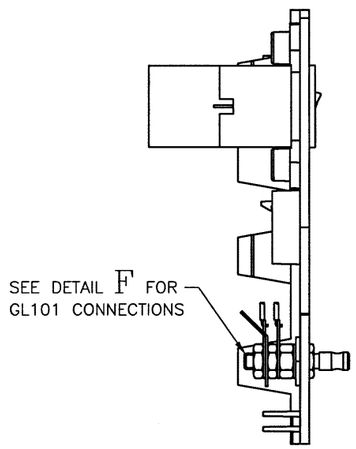
TITLE
MAIN ASSEMBLY, MODEL 7300 – NICO

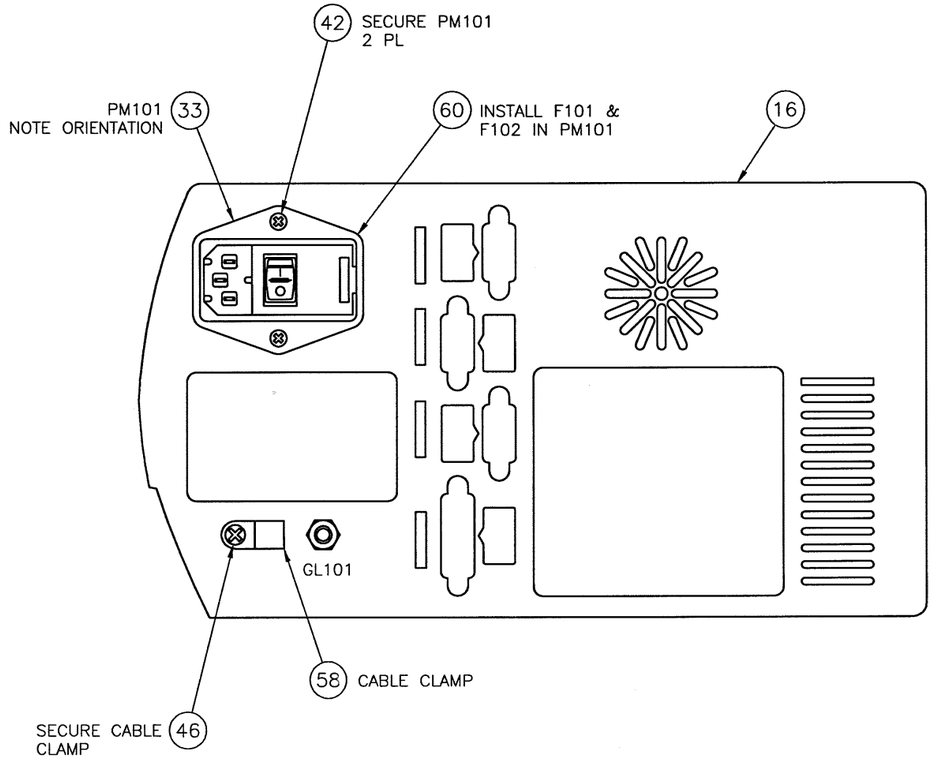
SIZE	DRAWING NO.	CODE	REV
D	9226	01	00

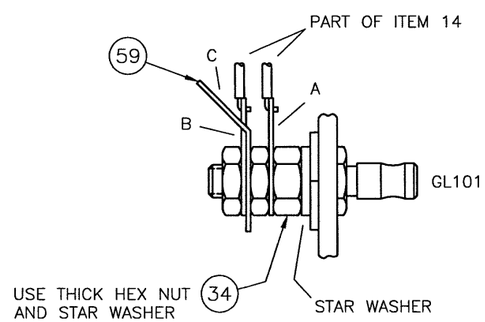
SCALE: 1/1 SHEET 4 OF 5



DETAIL C







DETAIL F

SCALE: 2/1

SEE REAR VIEW OF GL101 FOR
ORIENTAITON OF GROUND LUGS

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REV	R NO.	DATE

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TOLERANCES
.XX ±.01 [.254]
.XXX ±.005 [.127]
.XXXX ±.0025 [.064]
FRAC ±1/64
ANG ±1/4°

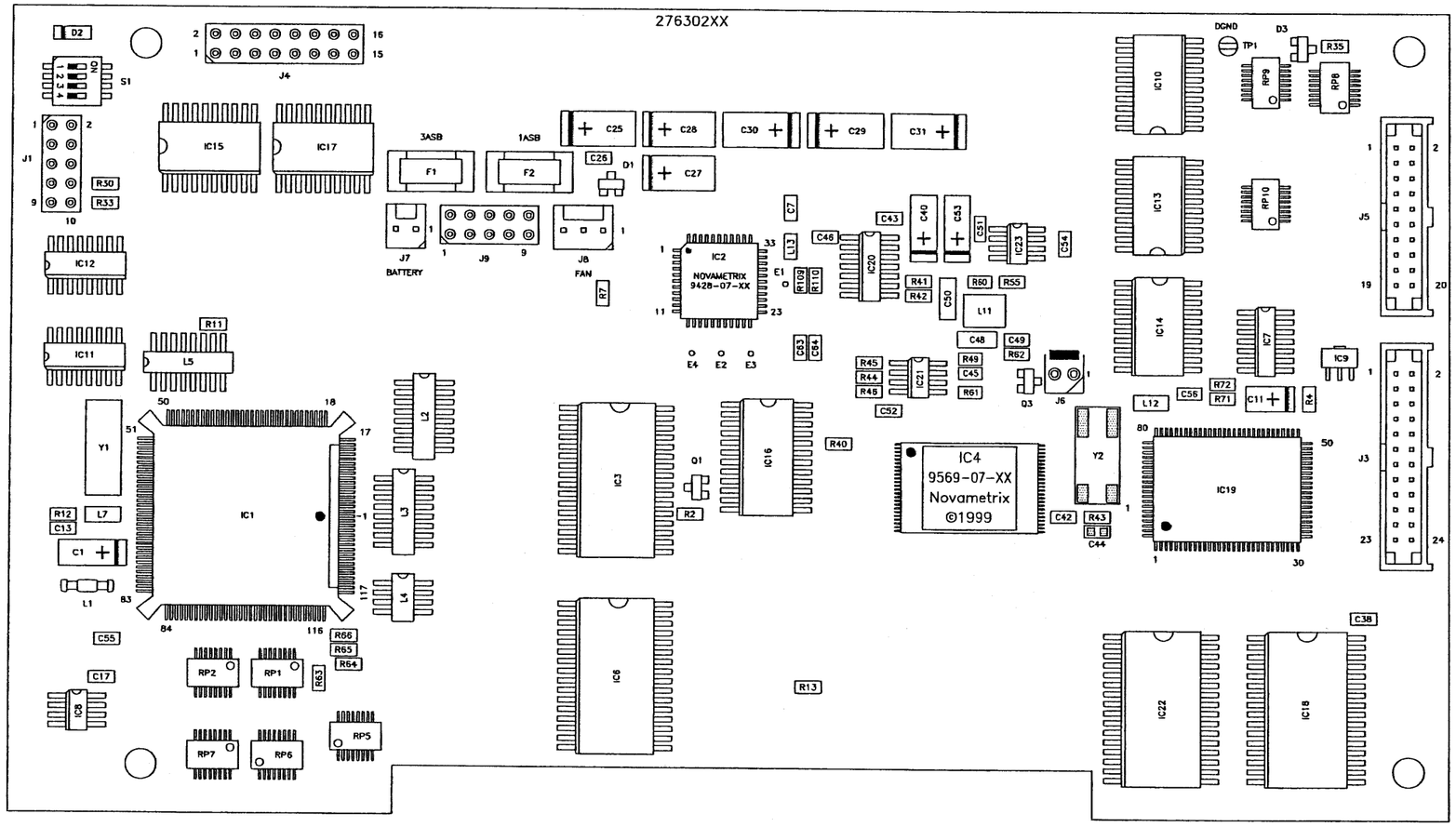
DRAWN B. Lancaster	DATE 31Dec98
CHECK MRL	DATE 19Feb99
MFG ENGR BN	DATE 18Feb99
ENGR J SANDOR	DATE 19Feb99
PROJ ENGR DRR	DATE 2/18/99
NEXT ASSY: D9226-00	

NOVAMETRIX MEDICAL SYSTEMS INC.

TITLE: MAIN ASSEMBLY, MODEL 7300 – NICO

SIZE	DRAWING NO.	CODE	REV
D	9226	01	00

SCALE: 1/1 SHEET 5 OF 5



NOTES:

1. FOR TEST PROCEDURE SEE A2763-04.
2. THE FOLLOWING COMPONENTS ARE NOT FITTED: C44, J1, J4, J6, J9, R3, R31, R32, R57, R59, R92, R93, R106, R107, Y2

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REV	R NO.	DATE
01	N660	26Apr99

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [mm]
TOLERANCES
.XX ±.01 [.254]
.XXX ±.005 [.127]
.XXXX ±.0025 [.064]
FRAC ±1/64
ANG ±1/4°

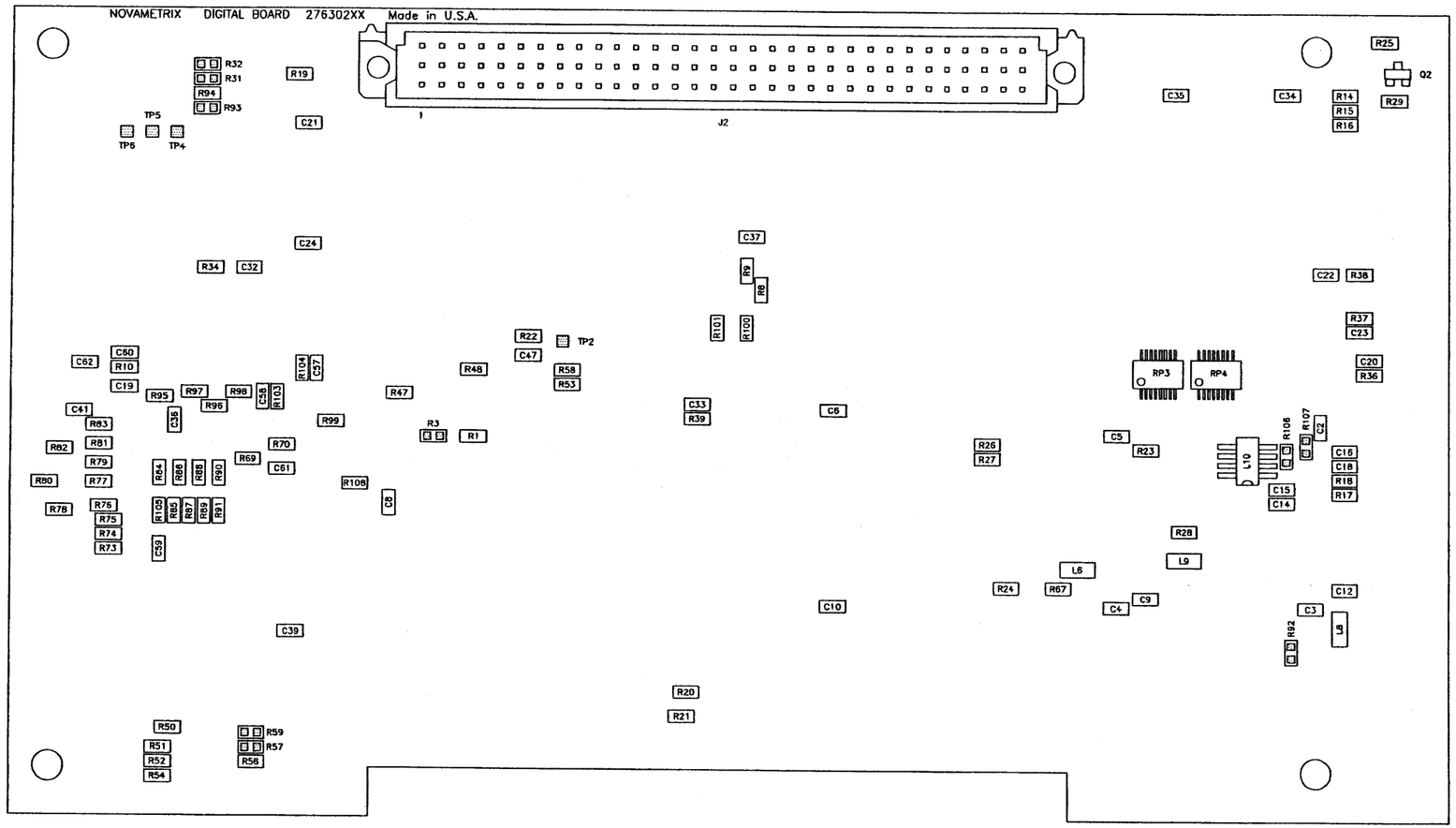
DRAWN	Bob Lancaster	DATE 3Nov98
CHECK	MRL	DATE
MFG ENGR	MJC	DATE 2/9/99
ENGR	RHO	DATE 2/9/99
PROJ ENGR	DRR	DATE 2/9/99
USED ON: D9226-01		

NOVAMETRIX MEDICAL SYSTEMS INC.

TITLE: DIGITAL BOARD ASSY, MODEL 7300 – NICO

SIZE	DRAWING NO.	CODE	REV
D	2763	01	01

SCALE: 3/1 SHEET 1 OF 3



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REV	R NO.	DATE
01	N660	26Apr99

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DIMENSIONS ARE IN INCHES [mm]
TOLERANCES
XX ±.01 [.254]
XXX ±.005 [.127]
XXXX ±.0025 [.064]
FRAC ±1/64
ANG ±1/4°

DRAWN	Bob Lancaster	DATE 3Nov98
CHECK	MRL	DATE
MFG ENGR	WJC	DATE 2/9/99
ENGR	RHD	DATE 2/9/99
PROJ ENGR	DRR	DATE 2/9/99
USED ON: D9228-01		

NOVAMETRIX MEDICAL SYSTEMS INC.

TITLE: DIGITAL BOARD ASSY, MODEL 7300 – NICO

SIZE	DRAWING NO.	CODE	REV
D	2763	01	01

SCALE: 3/1 SHEET 2 OF 3

PN	DESCRIPTION	REF DES
2763-02	FAB, DIGITAL BOARD	~
B2763-03	SCHEMATIC, DIGITAL BOARD	~
A2763-04	TEST PROCEDURE, DIGITAL BOARD	~
A9428-07	PROGRAM, CPLD ASSY, DISPLAY INTERFACE	IC2
A9569-07	PROGRAM, FLASH PEROM ASSY, BOOT CODE-SYS	IC4
154069	CAPACITOR, 4.7uF, 10V, 10%, TANTALUM	C11
154072	CAPACITOR, .1uF, 50V, 10%	C48, C50
154079	CAPACITOR, 10uF, 25V, 10%	C1, C40, C53
154104	CAPACITOR, .01uF, 50VDC, 10%	C2-C6, C8, C10, C14, C17, C21, C24, C32-C39, C41, C43, C45-C47, C49, C51, C52, C54, C59, C61
154105	CAPACITOR, 47pF, 50VDC, 5%	C62
154106	CAPACITOR, 22pF, 50VDC, 5%	C16, C18, C22, C23
154108	CAPACITOR, 100pF, 50VDC, 5%	C9, C12, C55, C60
154112	CAPACITOR, .047uF, 16VDC, 10%	C15, C19, C26
154116	CAPACITOR, 10uF, 35V, 10%	C25, C27-C31
154119	CAPACITOR, 6.8pF, 50V, 5%	C7, C13, C20, C42, C56-C58, C63, C64
180022	INDUCTOR, 10uH, 10%	L11
180029	INDUCTOR, 50MHz CUT-OFF FREQUENCY	L6-L9, L12
180030	INDUCTOR-CAP, 4700pF, 50VDC, 2A, 3 TERMINAL	L1
180034	FERRITE FILTER, 4 LINE, EMI SUPPRESSION	L4, L10
180035	FERRITE FILTER, 8 LINE, EMI SUPPRESSION	L2, L3, L5
180062	FERRITE BEAD, 1k OHM AT 100MHz	L13
☆210156	CONNECTOR, 96 PIN, HEADER, 3 ROW, .1 SP	J2
☆211213	CONNECTOR, 2 PIN, POST HEADER	J7
☆211327	CONNECTOR, 3 PIN, HEADER, STRAIGHT, .1 SP	J8
212543	CONNECTOR, 20 PIN, HEADER, DUAL ROW	J5
212510	CONNECTOR, 24 PIN, HEADER, DIL, .079 SP	J3
216029	TEST POINT, SPRING LOADED, 475°C MAX	TP1
230024	CRYSTAL, 32.768kHz	Y1
474194	RESISTOR, 2.2M OHM, 1/16W, 5%	R43
474222	RESISTOR, 10 OHM, 1/16W, 1%	R41, R94
474224	RESISTOR, 100 OHM, 1/16W, 1%	R4, R12, R29, R36-R38, R47, R62-R67, R69-R91, R95-R99, R103-R105, R109, R110
474225	RESISTOR, 499 OHM, 1/16W, 1%	R25
474227	RESISTOR, 1k OHM, 1/16W, 1%	R10, R11, R34, R61, R108
474231	RESISTOR, 4.99k OHM, 1/16W, 1%	R7, R8
474233	RESISTOR, 10k OHM, 1/16W, 1%	R1, R9, R19-R24, R26-R28, R30, R33, R48-R56, R60, R100, R101
474235	RESISTOR, 24.9k OHM, 1/16W, 1%	R42, R44, R58
474236	RESISTOR, 33.2k OHM, 1/16W, 1%	R45, R46
474240	RESISTOR, 100k OHM, 1/16W, 1%	R2, R13-R16, R35, R39, R40
474242	RESISTOR, 249k OHM, 1/16W, 1%	R17
474247	RESISTOR, 10M OHM, 1/16W, 5%	R18
474311	RES PACK, 51 OHM, .1W, 5%, 8 ISOLATED RES	RP1-RP4, RP9, RP10
474313	RES PACK, 10k OHM, .1W, 5%, 15 RES, 16 PIN	RP5-RP7
474316	RES PACK, 100k OHM, .1W, 5%, 15 RES, 16 PN	RP8

PN	DESCRIPTION	REF DES
481546	DIODE, SWITCHING	D1, D3
482551	LED, RED, WITH LENS	D2
483019	TRANSISTOR, PNP, SOT-23	Q3
485532	TRANSISTOR, N-CHAN ENHAN MODE	Q1, Q2
486037	IC, 128k X 8 BITS RAM, 32 PIN	IC18, IC22
486042	IC, SERIAL 4k EEPROM, 8 PIN	IC8
486055	IC, STATIC RAM, 4M BIT, 512k X 8-BIT, SOP	IC3, IC6
486314	IC, OCTAL BUFFER/LINE DRIVER-RECEIVER	IC10, IC13
486320	IC, HEX SCHMITT-TRIGGER INVERTER	IC7
486323	IC, OCTAL D-TYPE LATCH WITH 3-STATE OUTPUT	IC14, IC15, IC17
486348	IC, 12-STAGE BINARY COUNTER, 16 PIN	IC12
486365	IC, MICROCONTROLLER, 25.17MHz	IC1
486367	IC, DECADE COUNTER, HIGH SPEED, 16 PIN	IC11
486481	IC, QUAD 8-BIT D-TO-A CONVERTER, 14 PIN	IC20
486790	IC, DUAL OP AMP, HIGH SPEED, LOW POWER	IC21
487094	IC, REAL TIME CLOCK WITH QUARTZ CRYSTAL	IC16
487114	IC, AUDIO AMPLIFIER, LOW POWER, 8 PIN	IC23
487132	IC, SUPPLY VOLT RGLTR & VOLT DET, 4 PIN	IC9
487138	IC, GRAPHICS LCD CONT, LOW POWER, 100 PIN	IC19
513010	SWITCH, SLIDE, SPDT, 4 SWITCHES, .050 SP	S1
515087	FUSE WITH FUSEHOLDER, 1A, 125V, SLO-BLO	F2
515094	FUSE WITH FUSEHOLDER, 3A, 125V, SLO-BLO	F1

PN	DESCRIPTION	REF DES

PN	DESCRIPTION	REF DES

NOTES:

☆ DENOTES THRU HOLE COMPONENTS.

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TOLERANCES
.XX ±.01 [.254]
.XXX ±.005 [.127]
.XXXX ±.0025 [.064]
FRAC ±1/64
ANG ±1/4°

REV	R NO.	DATE
01	N560	26Apr99

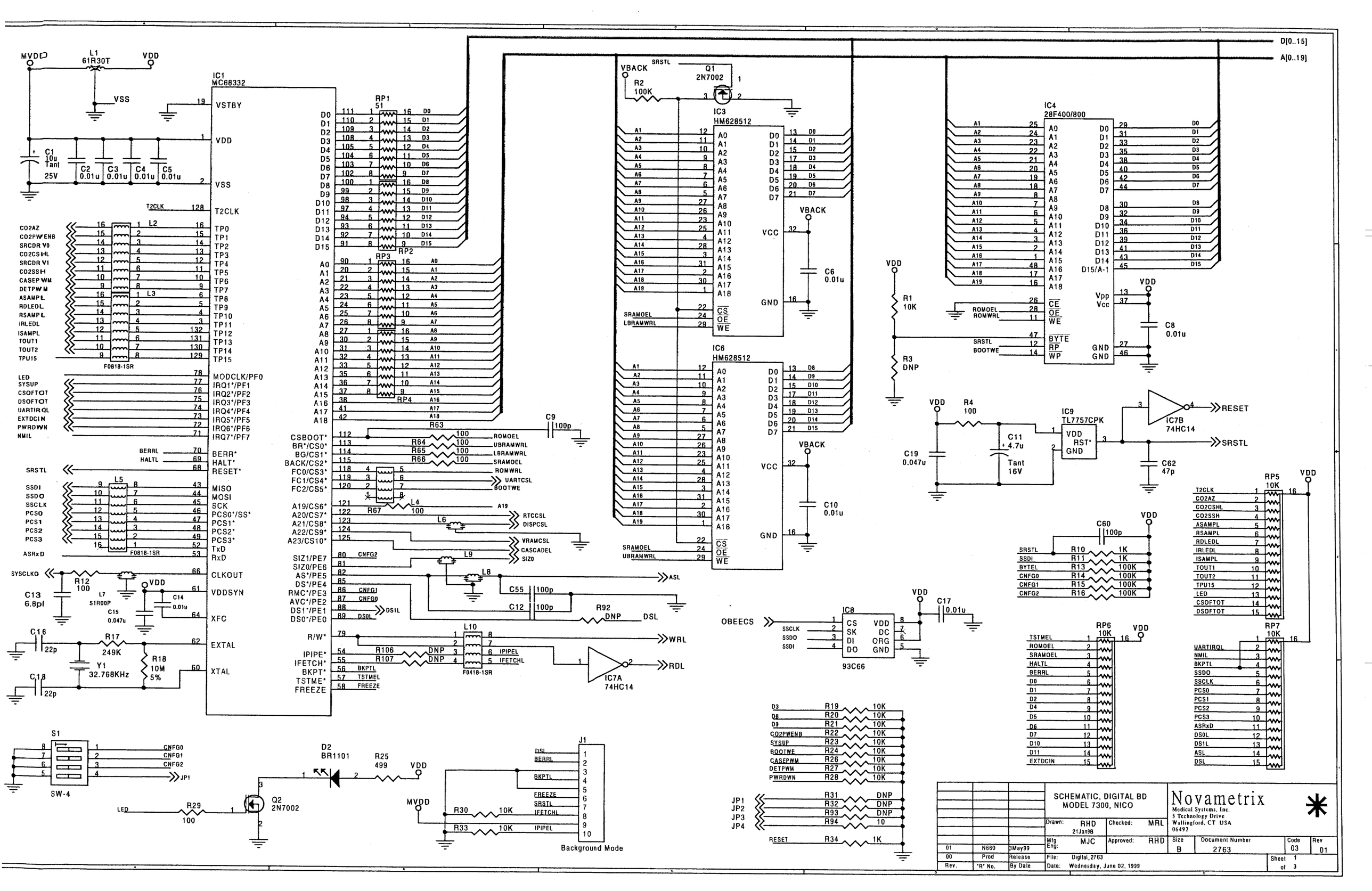
DRAWN	Bob Lancaster	DATE 3Nov98
CHECK	MRL	DATE
MFG ENGR	MJC	DATE 2/9/99
ENGR	RHD	DATE 2/9/99
PROJ ENGR	DRR	DATE 2/9/99
NEXT ASSY: D9228-01		

NOVAMETRIX MEDICAL SYSTEMS INC.

TITLE
DIGITAL BOARD ASSY, MODEL 7300 – NICO

SIZE	DRAWING NO.	CODE	REV
D	2763	01	01

SCALE: NONE SHEET 3 of 3


MVDD
L1
61R30T
VDD
VSS
IC1
MC68332
VSTBY
VDD
VSS
C1
10u
Tant
25V
C2
0.01u
C3
0.01u
C4
0.01u
C5
0.01u
T2CLK
T2CLK
CO2AZ
CO2PWENB
SRCDR V0
CO2CSHL
SRCDR V1
CO2SSH
CASEPWM
DETPWM
ASAMPL
RDLEDL
RSAMPL
IRLEDL
ISAMPL
TOUT1
TOUT2
TPU15
L2
L3
TP0
TP1
TP2
TP3
TP4
TP5
TP6
TP7
TP8
TP9
TP10
TP11
TP12
TP13
TP14
TP15
F0818-1SR
LED
SYSUP
CSOFTOT
DSOFTOT
UARTIRQL
EXTDCIN
PWRDWN
NMIL
MODCLK/PF0
IRQ1*/PF1
IRQ2*/PF2
IRQ3*/PF3
IRQ4*/PF4
IRQ5*/PF5
IRQ6*/PF6
IRQ7*/PF7
BERRL
HALTL
BERR*
HALT*
SRSTL
RESET*
SSDI
SSDO
SSCLK
PCS0
PCS1
PCS2
PCS3
ASRxD
L5
MISO
MOSI
SCK
PCS0*/SS*
PCS1*
PCS2*
PCS3*
TxD
RxD
F0818-1SR
SYSCLKO
R12
100
CLKOUT
VDDSYN
C13
6.8pf
L7
51R00P
C14
0.01u
C15
0.047u
XFC
C16
22p
R17
249K
R18
10M
5%
EXTAL
Y1
32.768KHz
XTAL
C18
22p
RP1
51
RP2
RP3
RP4
D0
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
A16
A17
A18
R63
R64
R65
R66
100
CSBOOT*
BR*/CS0*
BG/CS1*
BACK/CS2*
FC0/CS3*
FC1/CS4*
FC2/CS5*
ROMOEL
UBRAMWRL
LBRAMWRL
SRAMOEL
ROMWRL
UARTCSL
BOOTWE
C9
100p
L4
R67
100
A19/CS6*
A20/CS7*
A21/CS8*
A22/CS9*
A23/CS10*
A19
RTCCSL
DISPCSL
VRAMCSL
CASCADEL
SIZ0
SIZ1/PE7
SIZ0/PE6
AS*/PE5
DS*/PE4
RMC*/PE3
AVC*/PE2
DS1*/PE1
DS0*/PE0
CNFG2
CNFGJ
CNFG0
DS1L
DS0L
L6
L9
L8
ASL
C55
100p
C12
100p
R92
DNP
DSL
R/W*
IPIPE*
IFETCH*
BKPT*
TSTME*
FREEZE
R106
R107
DNP
L10
IPIPEL
IFETCHL
WRL
RDL
IC7A
74HC14
VBACK
SRSTL
Q1
2N7002
R2
100K
IC3
HM628512
SRAMOEL
LBRAMWRL
C6
0.01u
IC6
HM628512
SRAMOEL
UBRAMWRL
C10
0.01u
D[0..15]
A[0..19]
IC4
28F400/800
ROMOEL
ROMWRL
SRSTL
BOOTWE
C8
0.01u
R1
10K
R3
DNP
R4
100
C19
0.047u
C11
4.7u
Tant
16V
IC9
TL7757CPK
VDD
RST*
GND
IC7B
74HC14
RESET
SRSTL
C62
47p
RP5
10K
T2CLK
CO2AZ
CO2CSHL
CO2SSH
ASAMPL
RSAMPL
RDLEDL
IRLEDL
ISAMPL
TOUT1
TOUT2
TPU15
LED
CSOFTOT
DSOFTOT
C60
100p
R10
1K
R11
1K
R13
100K
R14
100K
R15
100K
R16
100K
SRSTL
SSDI
BYTEL
CNFG0
CNFG1
CNFG2
OBEECS
IC8
93C66
CS
SK
DI
DO
VDD
DC
ORG
GND
C17
0.01u
RP6
10K
RP7
10K
TSTMEL
ROMOEL
SRAMOEL
HALTL
BERRL
D0
D1
D2
D4
D5
D6
D7
D10
D11
EXTDCIN
UARTIRQL
NMIL
BKPTL
SSDO
SSCLK
PCS0
PCS1
PCS2
PCS3
ASRxD
DS0L
DS1L
ASL
DSL
S1
SW-4
CNFG0
CNFG1
CNFG2
JP1
D2
BR1101
R25
499
R29
100
LED
Q2
2N7002
J1
DSL
BERRL
BKPTL
FREEZE
SRSTL
IFETCHL
IPIPEL
R30
10K
R33
10K
Background Mode
D3
D8
D9
CO2PWENB
SYSUP
BOOTWE
CASEPWM
DETPWM
PWRDWN
R19
R20
R21
R22
R23
R24
R26
R27
R28
10K
JP1
JP2
JP3
JP4
R31
R32
R93
R94
DNP
10
RESET
R34
1K
SCHEMATIC, DIGITAL BD
MODEL 7300, NICO
Novametrix
Medical Systems, Inc.
5 Technology Drive
Wallingford, CT USA
06492
Drawn: RHD 21Jan98
Checked: MRL
Mfg Eng: MJC
Approved: RHD
Size: B
Document Number: 2763
Code: 03
Rev: 01
01 N660 3May99
00 Prod Release
Rev. *R* No. By Date
File: Digital_2763
Date: Wednesday, June 02, 1999
Sheet 1 of 3

A[0..19]
D[0..15]

VDD
RP8 100K
R35 100K
TP4
TP5
TP6
JP3
JP4
JP1
JP2
PWRSW
SPKR2
SPKR1
D3 D914
RP9 51
IC10 74HC541
SYSIN1L
RDL
C21 0.01u
IC7C
IC7D
IC7E
74HC14
RP10 51
ADJUP
ADJDOWN
NEXTITEM
DATA
MAIN
PAUSE
SILENCE
DIM
IC13 74HC541
C24 0.01u
J3
S4
RU
RD
RS
S5
S1
S3
S2
S6
L5 EXTONLED
L6 DATALED
L1 MAINLED
L4 PAUSELED
L2 SLNCRLED
L3 SLNCYLED
Keypanel
LINEST
IC14 74HC573
SPO2LPON
SAMPLE
CNTRLO1
C32 0.01u
SYSOUT1
RESET
IC15 74HC573
J4
PD0
PD1
PD2
PD3
PD4
PD5
PD6
PD7
PD8
PD9
PD10
PD11
PD12
PD13
PD14
PD15
Profile
IC17 74HC573
C34 0.01u
C35 0.01u
PROFILE
RESET

IC11 MC74HC4017
SYSCLKO
RESET
IC12 74HC4040
R36 100
R37 100
R38 100
C20 6.8pf
C22 22p
C23 22p
SPO2CLK
FLOWCLK
PSSYNC
SSCLK
SSDO
SSDI
PCS0
PCS1
PCS2
PCS3
DBDACL
OBEECS
WRL
RDL
EXTDCIN
LINEST
PWRSW
PWRDWN
SYSUP
LCDENB
RESET
VBATT
DVDD
DISPVA
VBACK
C25 10u Tant 35V
C26 0.047u
C27 10u Tant 35V
C28 10u Tant 35V
C29 10u Tant 35V
SPO2VLED
J2
InterBd
CO2AZ
CO2PWENB
SRCDRV0
CO2CSH
SRCDRV1
CO2SSH
CASEPWM
DETPWM
ASAMPL
RDLEDL
RSAMPL
IRLEDL
ISAMPL
UARTCSL
UARTIRQL
SYSIN2L
SYSOUT2
SYSOUT3
CSOFTOT
DSOFTOT
SRSTL
SPO2LPON
SAMPLE
CNTRLO1
VHTR
+VA
-VA
C30 10u Tant 35V
C31 10u Tant 35V
F1 3A SB
J7
Battery
F2 125mA FB
J8
Fan
D1 D914

IC16 RTC62423
VBACK
C33 0.01u
R39 100K
R40 100K
SRSTL
RDL
WRL
RTCCSL

NOTES:
1. UNLESS OTHERWISE SPECIFIED RESISTANCE VALUES ARE IN OHMS , 1/16 W , 1%.
2. UNLESS OTHERWISE SPECIFIED CAPACITANCE VALUES ARE IN FARADS
3. UNLESS OTHERWISE SPECIFIED INDUCTANCE VALUES ARE IN HENRYS
4. LAST USED REFERENCES: C64,D3,E4,F2,IC23,J9,L13,Q3,R110,RP10,S1,TP6,Y2
5. NOT FITTED: C44,J1,J4,J6,J9,Y2,R3,R31,R32,R57,R59,R92,R93,R106,R107,Y2
6. REFDES NOT USED: IC5, R5,R6,R68,R102

			SCHEMATIC, DIGITAL BD MODEL 7300, NICO			Novametrix	
						Medical Systems, Inc. 5 Technology Drive Wallingford, CT USA 06492	
			Drawn: RHD 21Jan98	Checked: MRL			
			Mfg Eng: MJC	Approved: RHD	Size B	Document Number 2763	Code 03 / Rev 01
01	N660	3May99	File: Digital_2763				
00	Prod	Release	Date: Wednesday, June 02, 1999				Sheet 2 of 3
Rev.	"R" No.	By Date					

A[0..19]
D[0..15]

J9
JTAG ISP

R7 4.99K
R8 4.99K
R9 10K

IC2
MACH4

SYSCLKO
E1

IC19
SED1353F

C36 0.01u
C37 0.01u
C59 0.01u

R100 10K
R101 10K
E2
E3

R105 100

R108 1K

SRSTL
DISPCSL
WRL
ASL
VRAMCSL
SIZ0
DISPDTKL

CASCADEL
CO2CSHL
CO2CSH
E4
SYSIN1L
SYSIN2L

DISPRST
IOCSL
DISPWRL
DISPASL
MEMCSL
DISPLDSL
DISPUDSL
DISPCLK

DS1L
SYSOUT1
SYSOUT2
SYSOUT3
PROFILE

R109 100
R110 100
L13 BLM21B102SPT

C61 0.01u

DVDD
R41 10
C40 10u Tant 25V
R42 24.9K

IC20
TLC5620C

SSDO
SSCLK
DBDACL

SPO2VLED

R44 24.9K
R45 33.2K
TP2
R46 33.2K

C7 6.8pf
C64 6.8pf
C63 6.8pf

C42 6.8p
Y2 DNP
C44 DNP
R43 2.2M 5%

TOUT1
TOUT2

C46 0.01u

C45 0.01u
TP3
R49 10K

+VA
-VA

IC21A
TLE2022

R48 10K
Q3
T2907A
R47 100
J6
DNP

R53 10K
R58 24.9K
C47 0.01u

IC21B
TLE2022

C48 0.1u
L11 10u
R60 10K
R55 10K

IC23
MC34119

C49 0.01u
C50 0.1u
C51 0.01u
C53 10u Tant 25V
R61 1K
R62 100
C52 0.01u
C54 0.01u

SPKR1
SPKR2

SYSUP
74HC14
IC7F

TP1
DGND

R74 100
R75 100
R76 100
R77 100
R73 100
R78 100
R79 100
R80 100
R81 100
R95 100
R84 100
R85 100
R86 100
R87 100
R88 100
R89 100
R90 100
R91 100
R96 100
R97 100
R98 100
R99 100
R72 100
R71 100
R70 100
R69 100
R103 100
R104 100

L12 51R00P

IC18
HM628128

IC22
HM628128

C38 0.01u
C39 0.01u
C41 0.01u

DISPVA
J5
Display

VSYNC
HSYNC
VCLK
VID0
VID1
VID2
VID3

R50 10K
R51 10K
R52 10K
R54 10K
R56 10K
R57 DNP
R59 DNP

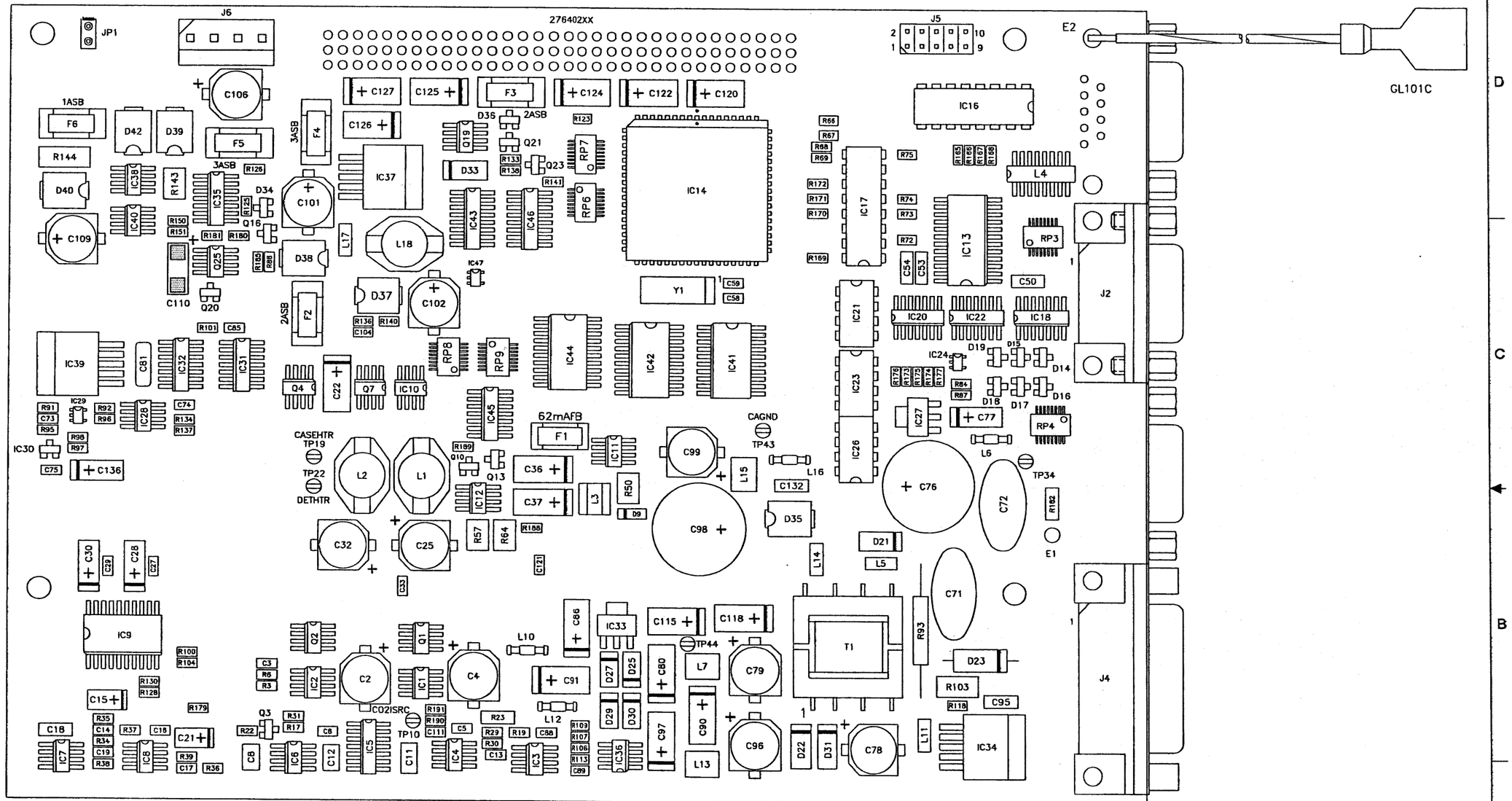
C56 6.8pf
C57 6.8pf
C58 6.8pf

LCDENB

SCHEMATIC, DIGITAL BD, MODEL 7300, NICO

Novametrix
Medical Systems, Inc.
5 Technology Drive
Wallingford, CT USA
06492

Drawn: RHD 21Jan98	Checked: MRL						
Mfg Eng: MJC	Approved: RHD	Size B	Document Number 2763	Code 03	Rev 01		
01	N660	3May99	File: Digital_2763	Sheet 3 of 3			
00	Prod	Release	Date: Wednesday, June 02, 1999				
Rev.	"R" No.	By Date					



SEE SHEET 2 FOR BOTTOM SIDE ASSY

NOTES:
1. FOR TEST PROCEDURE SEE A2764–04.
2. COMPONENTS NOT FITTED: C69, C110, JP1, R185

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.XX ±.01 [.254]
.XXX ±.005 [.127]
.XXXX ±.0025 [.064]
FRAC ±1/32
ANG ±1/4°

REV	R NO.	DATE
D1	N660	27Apr99

	DATE
DRAWN Bob Lancaster	11Nov98
CHECK URL	17Feb99
MFG ENGR MJC	2/17/99
ENGR RHD	Feb17,99
PROJ ENGR DRR	2/17/99

USED ON: D9228-01

NOVAMETRIX MEDICAL SYSTEMS INC.

TITLE: POWER BOARD ASSY, MODEL 7300 – NICO

SIZE	DRAWING NO.	CODE	REV
D	2764	01	01

SCALE: 3/1 SHEET 1 OF 3

NOVAMETRIX 276402XX Made in U.S.A.

J8

J3

J1

J7

J9

IC15 IC19 IC25

D13 D12 D20 D26 D32 D24 D28 D43 D5 D7 D11 D10 D8 D8 D1 D2 D3 D4 D15

Q22 Q18 Q24 Q27 Q6 Q9 Q5 Q8 Q15 Q11 Q12 Q14 Q17

L20 L22 L23 L9 L3

C137 C135 C117 C20

TP51 TP54 TP48 TP59 TP47 TP60 TP57 TP45 TP64 TP61 TP53 TP58 TP62 TP68 TP42 TP18 TP21 TP31 TP56 TP20 TP17 TP24 TP25 TP27 TP52 TP28 TP26 TP23 TP35 TP33 TP32 TP30 TP50 TP39 TP38 TP46 TP49 TP40 TP41 TP3 TP1 TP2 TP5 TP11 TP6 TP13 TP12 TP7 TP15 TP14 TP55 TP16 TP37 TP4 TP8 TP9

R85 R83 R77 R78 R71 R61 R82 R119 R102 R93 R108 R149 R152 R116 R148 R160 R154 R147 R162 R117 R135 R115 R164 R163 R110 R113 R161 R156 R155 R158 R145 R107 R183 R122 R139 R105 R129 R116 R114 R111 R127 R100 R124 R132 R142 R63 R48 R41 R46 R31 R49 R44 R42 R47 R40 R45 R99 R53 R187 R159 R46 R63 R60 R44 R58 R43 R54 R65 R51 R59 R62 R42 R52 R56 R157 R186 R41 R55 R94 R121 R112 R108 R120 R94 R121 R114 R111 R9 R12 R1 R4 R2 R5 R10 R18 R13 R8 R7 R14 R11 R15 R20 R92 R24 R25 R28 R27 R32 R33 R18 R21 R26 R131

C123 C52 C57 C49 C48 C51 C55 C62 C67 C61 C65 C59 C56 C63 C60 C76 C64 C66 C68 C70 C129 C128 C119 C114 C34 C38 C46 C39 C35 C45 C47 C61 C41 C40 C134 C103 C105 C139 C133 C31 C24 C23 C107 C108 C113 C26 C83 C87 C84 C131 C130 C82 C10 C9 C7 C92

R79 R80 R76 R70 R99 R86 R90 R178 R170

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01	N660	27Apr99	
REV	R NO.	DATE	

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [mm]
TOLERANCES
.XX ±.01 [.254]
.XXX ±.005 [.127]
.XXXX ±.0025 [.064]
FRAC ±1/64
ANG ±1/4°

DRAWN Bob Lancaster	DATE 11Nov98
CHECK WRL	DATE 17Feb99
MFG ENGR MJC	DATE 2/17/99
ENGR RHD	DATE Feb17,99
PROJ ENGR DRR	DATE 2/17/99
NEXT ASSY: D9228-01	

NOVAMETRIX MEDICAL SYSTEMS INC.

TITLE: POWER BOARD ASSY, MODEL 7300 – NICO

SIZE	DRAWING NO.	CODE	REV
D	2764	01	01

SCALE: 3/1 SHEET 2 OF 3

PN	DESCRIPTION	REF DES
2764-02	FAB, POWER BOARD	~
D2764-03	SCHEMATIC, POWER BOARD	~
A2764-04	TEST PROCEDURE, POWER BOARD	~
C6756-10	TRANSFORMER, MAIN BOARD, MODEL 8100	T1
B9330-01	GROUND WIRE ASSY	(FOR E2)
☆152085	CAPACITOR, 1500uF, 16V, ELECTROLYTIC	C76, C98
152096	CAPACITOR, 220uF, 35V, 20%, ELECTROLYTIC	C2, C4, C25, C32, C78, C79, C96, C99, C101, C102, C106, C109
153045	CAPACITOR, .47uF, 50V, .200 SPACING	C81
☆153063	CAPACITOR, 220pF, 3kV, 20%	C71, C72
154072	CAPACITOR, .1uF, 50V, 10%	C18, C34, C48-C50, C53-C55, C95
154079	CAPACITOR, 10uF, 25V, 10%	C20, C28, C30, C77, C136, C137
154081	CAPACITOR, 100pF, 100V, 10%	C129-C134
154086	CAPACITOR, 4.7uF, 10VDC, 20%	C15, C21
154093	CAPACITOR, 68uF, 16VDC, 10%	C36, C37
154103	CAPACITOR, .001uF, 50VDC, 10%	C9, C13, C84, C89
154104	CAPACITOR, .01uF, 50VDC, 10%	C1, C3, C5, C6, C10, C14, C16, C17, C19, C23, C24, C26, C27, C29, C31, C33, C35, C38, C40, C42, C43, C46, C47, C51, C52, C56, C60, C62-C64, C67, C68, C75, C82, C85, C87, C88, C92, C100, C103, C105, C107, C108, C111, C113, C114, C116, C119, C128
154105	CAPACITOR, 47pF, 50VDC, 5%	C41, C45, C94
154106	CAPACITOR, 22pF, 50VDC, 5%	C58
154108	CAPACITOR, 100pF, 50VDC, 5%	C39, C44, C83
154110	CAPACITOR, 3.3nF, 50VDC, 5%	C104
154111	CAPACITOR, .1uF, 16VDC, 5%	C7, C8, C11, C12
154112	CAPACITOR, .047uF, 16VDC, 10%	C57, C61, C65, C66, C70, C73, C74, C93, C121, C123
154116	CAPACITOR, 10uF, 35V, 10%	C22, C80, C86, C90, C91, C97, C115, C117, C118, C120, C122, C124-C127, C135
154118	CAPACITOR, 33pF, 50V, 5%	C59
180019	INDUCTOR, 100uH, 10%	L3
180022	INDUCTOR, 10uH, 10%	L7, L13, L15
180030	INDUCTOR-CAP, 4700pF, 50VDC, 2A, 3 TERMINAL	L6, L10, L12, L16, L20
180035	FERRITE FILTER, 8 LINE, EMI SUPPRESSION	L4
180045	INDUCTOR, 220uH, 20%	L1, L2
180047	INDUCTOR, 50 OHMS @ 100MHz, 3A	L5, L8, L9, L11, L14, L17, L22, L23
180057	INDUCTOR, 22uH, 20%, 2.6A	L18
☆210070	CONNECTOR, 96 PIN, RECEPTACLE, 3 ROW	J8
☆211411	CONNECTOR, PLUG, 4 PIN, LOCKING, SQ POST	J6
☆211924	CONNECTOR, 9 PIN, RECEPTACLE, RIGHT ANGLE	J1, J2, J3
☆212108	CONNECTOR, 10 PIN, HEADER, DUAL ROW, .1 SP	J5
☆212307	CONNECTOR, 15 PIN, RIGHT ANGLE, SOCKET	J4
213413	CONNECTOR, 40 PIN, HEADER, DIL, .078 SP	J7, J9

PN	DESCRIPTION	REF DES
☆218029	TEST POINT, SPRING LOADED, 475°C MAX	TP10, TP19, TP22, TP34, TP43, TP44
230028	CRYSTAL, 7.3728MHz, 20pF	Y1
☆471400	RESISTOR, 100M OHM, 1W, 5%, .9 PITCH	R93
474172	RESISTOR, 10 OHM, 1/8W, 1%	R129
474193	RESISTOR, 8.87k OHM, 1/16W, 1%	R136
474195	RESISTOR, 511k OHM, 1/16W, 1%	R91, R98, R119, R145, R150, R151, R181
474197	RESISTOR, 49.9k OHM, 1/16W, 1%	R132, R146
474198	RESISTOR, 2.49k OHM, 1/16W, 1%	R66-R69, R190
474220	RESISTOR, 0 OHM, 1/4W, 5%	R182
474222	RESISTOR, 10 OHM, 1/16W, 1%	R15, R16, R37-R39, R88
474224	RESISTOR, 100 OHM, 1/16W, 1%	R31-R33, R43, R48, R86, R109, R123, R162, R179, R186, R187, R191
474225	RESISTOR, 499 OHM, 1/16W, 1%	R44, R49, R72-R75, R81-R83, R85, R90, R105, R178
474227	RESISTOR, 1k OHM, 1/16W, 1%	R1, R2, R24, R25, R28, R58, R65, R70, R76, R79, R80, R89, R125, R140, R157, R159, R165-R177, R180
474228	RESISTOR, 1.21k OHM, 1/16W, 1%	R118
474229	RESISTOR, 2.05k OHM, 1/16W, 1%	R108, R107, R121, R159, R161
474230	RESISTOR, 3.32k OHM, 1/16W, 1%	R120
474231	RESISTOR, 4.99k OHM, 1/16W, 1%	R188, R189
474233	RESISTOR, 10k OHM, 1/16W, 1%	R3-R14, R17, R19, R22, R29, R34, R35, R36, R53, R71, R126, R137, R138, R141, R142, R154, R160, R183
474234	RESISTOR, 20.5k OHM, 1/16W, 1%	R18, R100
474235	RESISTOR, 24.9k OHM, 1/16W, 1%	R51, R54, R59, R61, R135
474236	RESISTOR, 33.2k OHM, 1/16W, 1%	R21, R56, R63, R112, R115
474238	RESISTOR, 37.4k OHM, 1/16W, 1%	R113, R116, R147, R156
474239	RESISTOR, 75k OHM, 1/16W, 1%	R130
474240	RESISTOR, 100k OHM, 1/16W, 1%	R20, R30, R40, R41, R45, R46, R52, R60, R77, R78, R84, R87, R101, R104, R108, R110, R122, R124, R128, R133, R134, R139, R148, R153, R155, R163
474241	RESISTOR, 150k OHM, 1/16W, 1%	R26, R111, R158
474242	RESISTOR, 249k OHM, 1/16W, 1%	R92, R96, R117, R152
474243	RESISTOR, 324k OHM, 1/16W, 1%	R114, R164
474245	RESISTOR, 1M OHM, 1/16W, 1%	R27, R42, R47, R102, R149, R184
474247	RESISTOR, 10M OHM, 1/16W, 1%	R99
474259	RESISTOR, 15k OHM, 1/16W, 1%	R131
474260	RESISTOR, 121k OHM, 1/16W, 1%	R95, R97
474261	RESISTOR, 7.5k OHM, 1/16W, 1%	R55, R62
474265	RESISTOR, 1 OHM, 1/4W, 1%	R23
474302	RESISTOR, 150 OHM, .33W, 5%	R143
474303	RESISTOR, 4.3 OHM, .75W, 5%	R144
474304	RESISTOR, 470k OHM, .75W, 5%	R94
474305	RESISTOR, 470 OHM, .75W, 5%	R103, R127
474306	RESISTOR, 26.7 OHM, .33W, 1%	R50
474307	RESISTOR, 3.32 OHM, .33W, 1%	R57
474308	RESISTOR, 5.6 OHM, .33W, 1%	R64
474311	RESISTOR PACK, 510 OHM, .1W, 5%, 16 PIN	RP9
474312	RESISTOR PACK, 1k OHM, .1W, 5%, 16 PIN	RP3, RP4
474316	RESISTOR PACK, 100k OHM, .1W, 5%, 16 PIN	RP6-RP8

PN	DESCRIPTION	REF DES
☆481036	DIODE, ZENER, 39V, 5W, 5%	D23
481046	DIODE, ZENER, 7.5V, 500mW	D9
481546	DIODE, SWITCHING	D10, D11, D24, D28, D32
481547	DIODE, HOT CARRIER, SCHOTTKY	D1, D2, D4, D34, D36, D43
481548	DIODE, RECTIFIER, SILICON	D25, D27, D29, D30
481549	DIODE, RECTIFIER	D6, D8, D21, D26, D33
481552	DIODE, SCHOTTKY, 40V, 3A	D35, D37-D40, D42
481555	DIODE, DUAL SWITCHING	D5, D7, D12-D20
481556	DIODE, DUAL SCHOTTKY, COMMON CATHODE	D3
481557	DIODE, SCHOTTKY, 1A, 100V	D22, D31
483019	TRANSISTOR, PNP, SOT-23	Q21
484061	TRANSISTOR, NPN, SOT-23	Q11, Q16, Q22-Q24
484062	TRANSISTOR, NPN, SOT-23	Q17
484541	VOLTAGE REGULATOR, +1.2V - +37V OUT, 8 PIN	IC11
484543	VOLTAGE REGULATOR, +5V OUT, 5%, SOP-8	IC38
484557	VOLTAGE REGULATOR, POSITIVE, 3 PIN	IC27
484562	IC, MICROPOWER REGULATOR, 8 PIN	IC36
484563	IC, VOLTAGE REGULATOR, POSIVE, ADJ, 3 PIN	IC33
484565	IC, VOLTAGE REGULATOR, 5A SWITCHING, 5 LEAD	IC34
484575	SWITCHING REGULATOR, 1.2V - 37V, 3A, 5 PIN	IC37
484576	VOLTAGE REGULATOR, ADJUSTABLE, 5 PIN	IC39
485532	TRANSISTOR, N-CHANNEL ENHANC MODE	Q3, Q5, Q6, Q8, Q9, Q12, Q14, Q15, Q18, Q20, Q27
485541	TRANSISTOR, MOSFET, DUAL P-CHAN ENHAN	Q4, Q7, Q19, Q25
485543	TRANSISTOR, MOSFET, N-CHAN & P-CHAN	Q1, Q2
485548	TRANSISTOR, N-CHAN ENHAN MODE	Q10, Q13

PN	DESCRIPTION	REF DES
486313	IC, QUAD ANALOG SWITCH	IC5
486314	IC, OCTAL BUFFER/LINE DRIVER-RECEIVER	IC44
486320	IC, HEX SCHMITT-TRIGGER INVERTER	IC15, IC45
486321	IC, 3-LINE TO 8-LINE DECODER	IC43, IC46
486323	IC, OCTAL D-TYPE LATCH WITH 3-STATE OUTPUT	IC41, IC42
486325	IC, QUAD 2-INPUT SCHMITT TRIGGER	IC31
486326	IC, DUAL D FLIP-FLOP	IC32
486340	IC, 12-BIT A TO D CONVERTER	IC9
486346	IC, 2-INPUT NAND GATE, CMOS, 5 PIN	IC25, IC47
486363	IC, QUAD UNIVERSAL ASYNCH RECEIVER & XMTR	IC14
486364	IC, 8-BIT A TO D CONVERTER, 14 PIN	IC20
486369	IC, 5V RS232 4-DRIVER/4-RECEIVER, 24 PIN	IC13
486481	IC, QUAD 8-BIT D TO A CONVERTER, 14 PIN	IC22
486781	IC, JFET INPUT OP AMP, LOW NOISE	IC12
486785	IC, QUAD VOLT COMPARATOR, ULTRA-LOW PWR	IC35
486790	IC, DUAL OP AMPLIFIER, HIGH SPEED, LOW PWR	IC3, IC28
486796	IC, DUAL OP AMP, RAIL TO RAIL, 8 PIN	IC4
486805	IC, DUAL VOLTAGE COMPARATOR, LOW POWER	IC6, IC40
486813	IC, QUAD FET INPUT OP AMP, 14 PIN	IC18
486821	IC, FET-INPUT OP AMP, LOW POWER, 8 PIN	IC8
486825	IC, OP AMP, LOW POWER, RAIL-TO-RAIL	IC24, IC29
486828	IC, MICROPOWER SERIES REFERENCE, 3 PIN	IC19, IC30
486831	IC, PRECISION 2.5V REF, 20mA MIN OUT, 8 PIN	IC7
487100	IC, INVERTING DUAL MOSFET DRIVER, 1.2A, 8 PIN	IC10
487103	IC, DUAL OPEN DRAIN FET DRIVER, NON-INV	IC2
487104	IC, DUAL OPEN DRAIN FET DRIVER, INVERTING	IC1
☆487145	IC, OPTOCOUPLER, DUAL, LOGIC GATE, 8 PIN	IC21, IC23, IC26
☆487146	IC, OPTOCOUPLER, 4-CHANNEL, 16 PIN	IC16, IC17
515085	FUSE WITH FUSEHOLDER, 2A, 125V, SLO-BLO	F2, F3
515087	FUSE WITH FUSEHOLDER, 1A, 125V, SLO-BLO	F6
515088	FUSE W FUSEHOLDER, 1/16A, 125V, V FAST-ACT	F1
515094	FUSE WITH FUSEHOLDER, 3A, 125V, SLO-BLO	F4, F5

NOTES:

☆ DENOTES THRU HOLE COMPONENTS.

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REV	R NO.	DATE
01	N660	27Apr99

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [mm]
TOLERANCES
XX ±.01 [.254]
XXX ±.005 [.127]
XXXX ±.0025 [.064]
FRAC ±1/64
ANG ±1/4°

DRAWN	Bob Lancaster	DATE 8Nov98
CHECK	MRL	DATE 17Feb99
MFG ENGR	WJC	DATE 2/17/99
ENGR	RHD	DATE Feb17,99
PROJ ENGR	DRR	DATE 2/17/99
USED ON: D9226-01		

NOVAMETRIX MEDICAL SYSTEMS INC.

TITLE: POWER BOARD ASSY, MODEL 7300 - NICO

SIZE	DRAWING NO.	CODE	REV
D	2764	01	01

SCALE: NONE SHEET 3 OF 3

SRCDRV0
SRCDRV1
CO2PWENB
RESET
CO2AZ
CO2CSH
CO2SRC+
CO2SRC-
CO2ISRC
DA5
DA2V5
-VSRC
+VSRC
VDD
DVDD
+VA

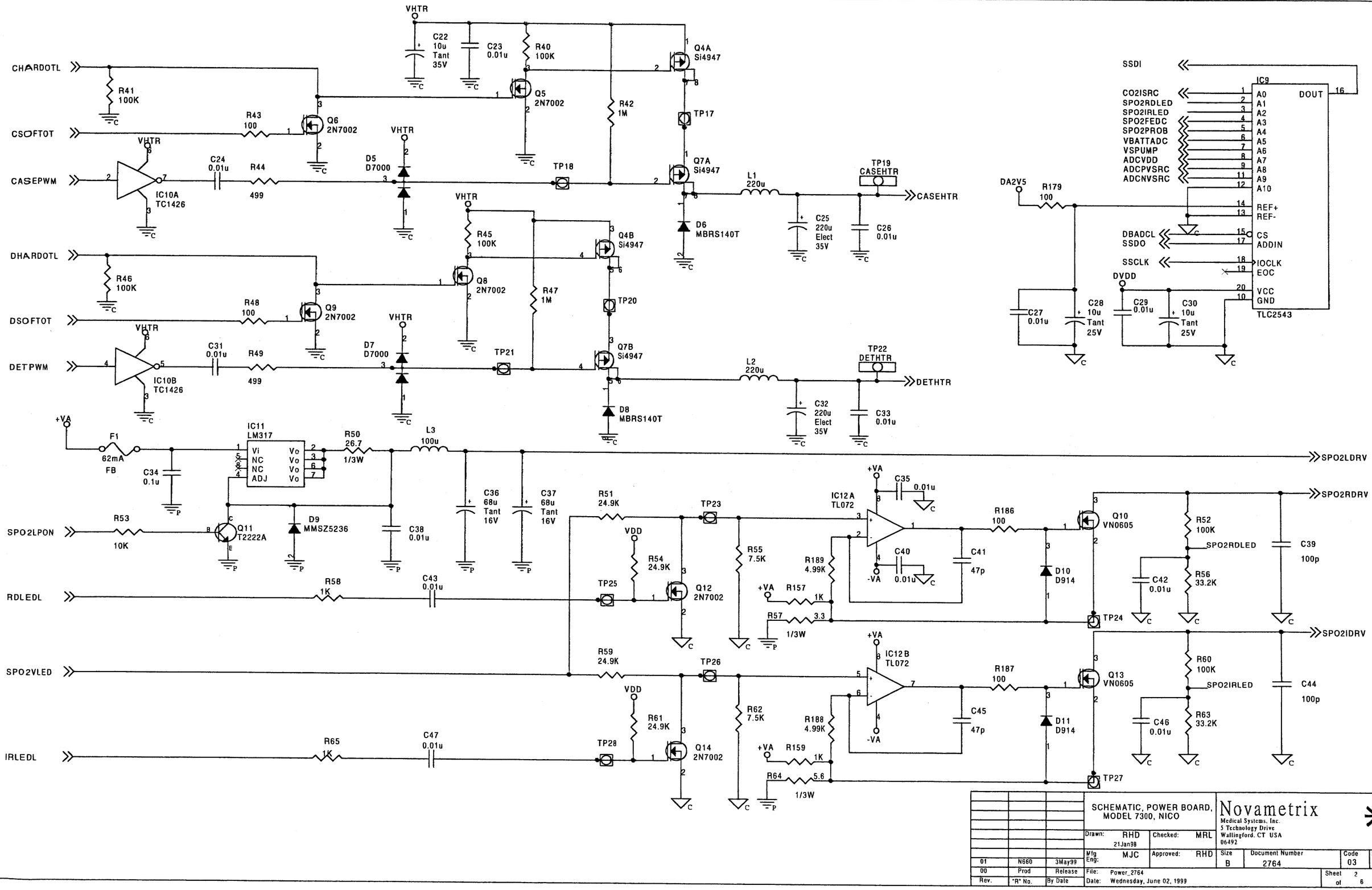
R3 10K
R6 10K
R1 1K
R4 10K
R11 10K
R14 10K
R9 10K
R12 10K
R15 10
R2 1K
R5 10K
R10 10K
R13 10K
R16 10
R7 10K
R8 10K
R17 10K
R18 20.5K
R21 33.2K
R22 10K
R26 150K
R31 100
R32 100
R33 100
R19 10K
R20 100K
R23 1 1/4W
R29 10K
R30 100K
R24 1K
R27 1M
R34 10K
R35 10K
R36 10K
R37 10
R38 10
R39 10
R190 2.49K
R191 100
R25 1K
R28 1K

C1 0.01u
C2 220u Elect 35V
C3 0.01u
C4 220u Elect 35V
C5 0.01u
C6 0.01u
C7 0.1u Poly
C8 0.1u Poly
C9 1000p
C10 0.01u
C11 0.1u Poly
C12 0.1u Poly
C13 1000p
C14 0.01u
C15 4.7u Tant 10V
C16 0.01u
C17 0.01u
C18 0.1u
C19 0.01u
C20 10u Tant 25V
C21 4.7u Tant 10V
C111 0.01u

IC1A TC4404
IC1B TC4404
IC2A TC4405
IC2B TC4405
IC3A TLE2022
IC4A TLC2272
IC4B TLC2272
IC5 CD4066
IC6A LM393
IC6B LM393
IC7 LT1460-2.5
IC8A AD822
IC8B AD822
Q1A Si4539
Q1B Si4539
Q2A Si4539
Q2B Si4539
Q3 2N7002
D1 BAT54
D2 BAT54
D3 D354
D4 BAT54

TP1 TP2 TP3 TP4 TP5 TP6 TP7 TP8 TP9 TP10 CO2ISRC TP11 TP12 TP13 TP14 TP15 TP16

<Title> MODEL 7300, NICO			Novametrix Medical Systems, Inc. 5 Technology Drive Wallingford. CT USA 06492		
Drawn: RHD 21Jan98	Checked: MRL				
Mfg Eng: MJC	Approved: RHD		Size B	Document Number 2764	Code 03 / Rev 01
01 N650 3May99					
00 Prod Release	File: Power_2764			Sheet 1 of 6	
Rev. *R* No. By Date	Date: Wednesday, June 02, 1999				



			SCHEMATIC, POWER BOARD, MODEL 7300, NICO	Novametrix Medical Systems, Inc. 5 Technology Drive Wallingford. CT USA 06492	
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01	N660	3May99	File: Power_2764		Sheet 2 of 6
00	Prod	Release	Date: Wednesday, June 02, 1999		
Rev.	*R* No.	By Date			

D[8..15]
A[1..5]

IC14
ST16C654

UARTCSL
WRL
SRSTL
UARTIRQL

VDD R71 10k
C58 22p
C59 33p
Y1 7.3728MHz

CLKSEL
XTAL1
XTAL2
16/68

VDD R77 100k
R78 100k

CNTRLIN1
CNTRLQ1
SRSTL

J5
Aux Serial

C52 0.01u

IC15A
IC15B
IC15C
IC15D
SN74HC14D

R66 2.49K
R67 2.49K
R68 2.49K
R69 2.49K

IC16
ILQ2

R165 R166 R167 R168 1K

IC17
ILQ2

R72 499
R73 499
R74 499
R75 499

R169 R170 R171 R172 1K

IC13
LT1134A

C48 C49 C53 C54 0.1u

C50 0.1u
C51 0.01u
C55 0.1u

RP3 1K
L4 F0818-1SR

J1 Serial A
J2 Serial B
J3 Serial C

TxA
RxA
CTSB
TxB
RTSB
RxB
TxC
RxC

C56 0.01u
R70 1K
IC18A TLC2274
D12 D7000

C57 0.047u
IC19
LT1460KCS3-2.5
TP29
IREF2V5

C60 0.01u
R76 1K
IC18B TLC2274
D13 D7000

C62 0.01u
IC20
TLC0834C
C61 0.047u

C63 0.01u
R79 1K
C64 0.01u
R80 1K
IC18C TLC2274
D14 D7000
D15 D7000
IC18D TLC2274

J4 Analog I/O
RP4 1K
IOSNSE

D16 D7000
D17 D7000
D18 D7000
D19 D7000

R173 R174 R175 R176 R177 1K

IC22
TLC5620C
C67 0.01u

C68 0.01u
IREF2V5
R84 100K
R86 100
R87 100K
R89 1K
IC24
LMC7101
C69 DNP

AIADCL
AODACL

IC21
HCPL-2631
R81 499
R82 499
C65 0.047u

SSCLK
SSDO

IC15E
IC15F
SN74HC14D

IC23
HCPL-2631
R83 499
R85 499
C66 0.047u

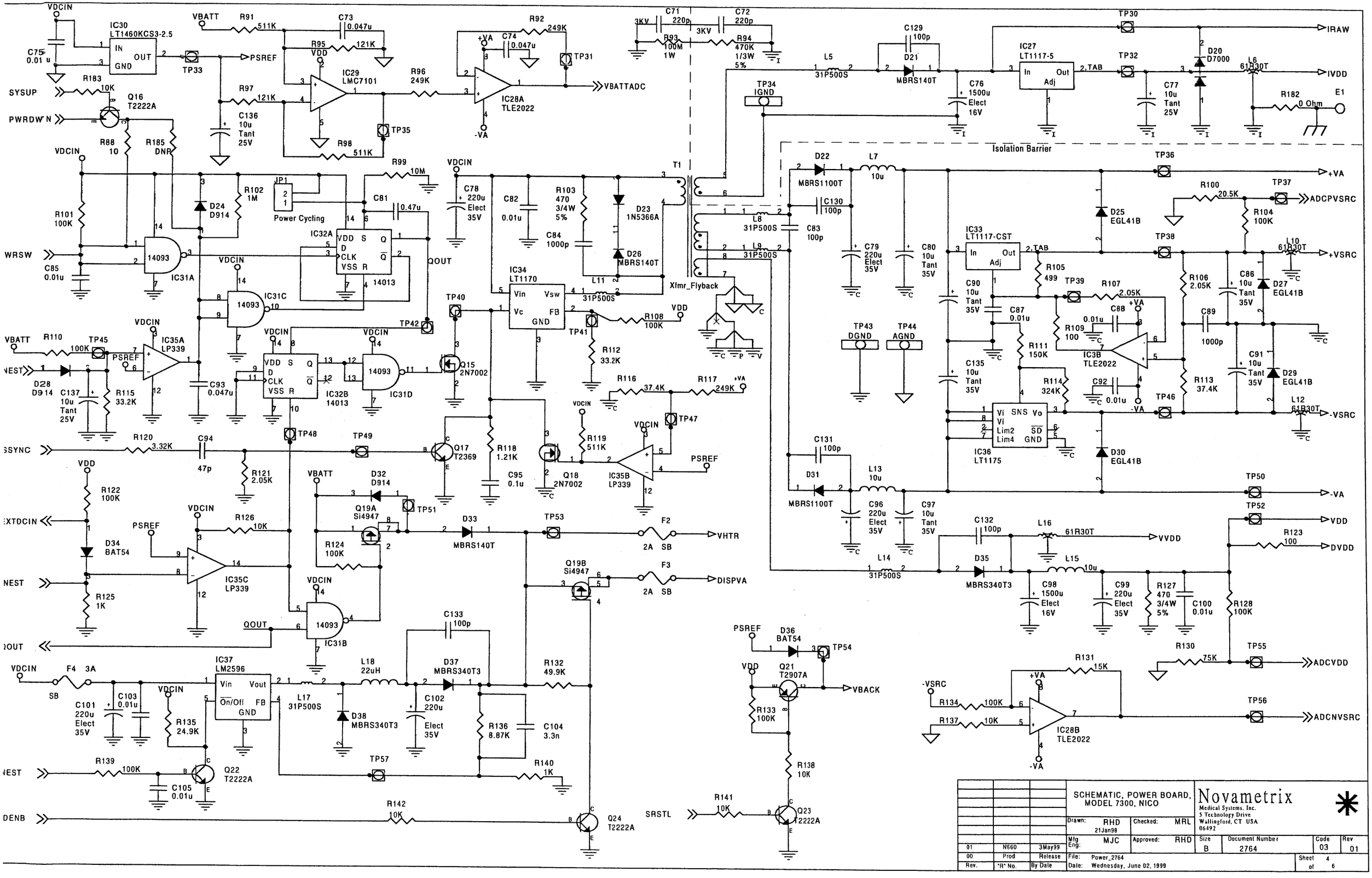
SSDI
CNTRLIN1

C70 0.047u
IC26
HCPL-2631
R90 499
R178 499
IC25
NC7S00

SCHEMATIC, POWER BOARD, MODEL 7300, NICO

Novametrix
Medical Systems, Inc.
5 Technology Drive
Wallingford. CT USA
06492

Drawn: RHD 21Jan98	Checked: MRL						
Mfg Eng: MJC	Approved: RHD	Size B	Document Number 2764	Code 03	Rev 01		
01	N660	3May99	File: Power_2764	Sheet 3 of 6			
00	Prod	Release	Date: Wednesday, June 02, 1999				
Rev.	"R" No.	By Date					



			SCHEMATIC, POWER BOARD, MODEL 7300, NICO		Novametrix Medical Systems, Inc. 5 Technology Drive Wallingford, CT USA 06492		
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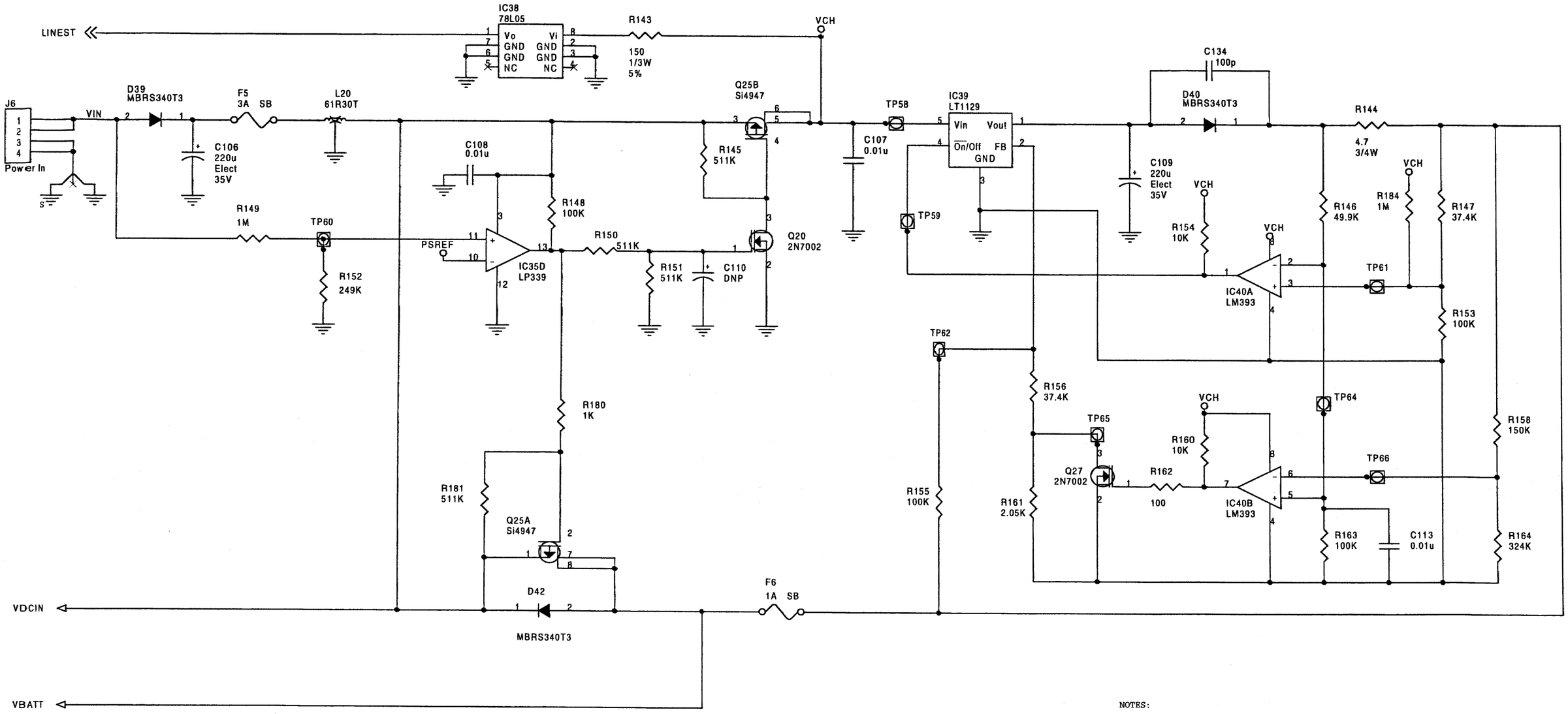
			Mfg Eng: MJC	Approved: RHD	Size: B	Document Number: 2764	Code: 03	Rev: 01
01	N560	3May99	File: Power_2764				
00	Prod	Release	Date: Wednesday, June 02, 1999				Sheet 4 of 6
Rev.	"R" No.	By Date					



NOTES:

1. UNLESS OTHERWISE SPECIFIED RESISTANCE VALUES ARE IN OHMS , 1/16W , 1%.
2. UNLESS OTHERWISE SPECIFIED CAPACITANCE VALUES ARE IN FARADS
3. UNLESS OTHERWISE SPECIFIED INDUCTANCE VALUES ARE IN HENRYS
4. LAST USED REF DES:
   C137,D43,E2,F6,IC47,JP1,J9,L23,Q27,RP9,R191,TP66,T1,Y1
5. COMPONENTS NOT FITTED:
   C69,C110,JP1,R185
6. REF DES NOT USED:
   C112,D41,L19,Q26,RP1,RP2,RP5

			SCHEMATIC, POWER BOARD, MODEL 7300, NICO		Novametrix Medical Systems, Inc. 5 Technology Drive Wallingford, CT USA 06492		
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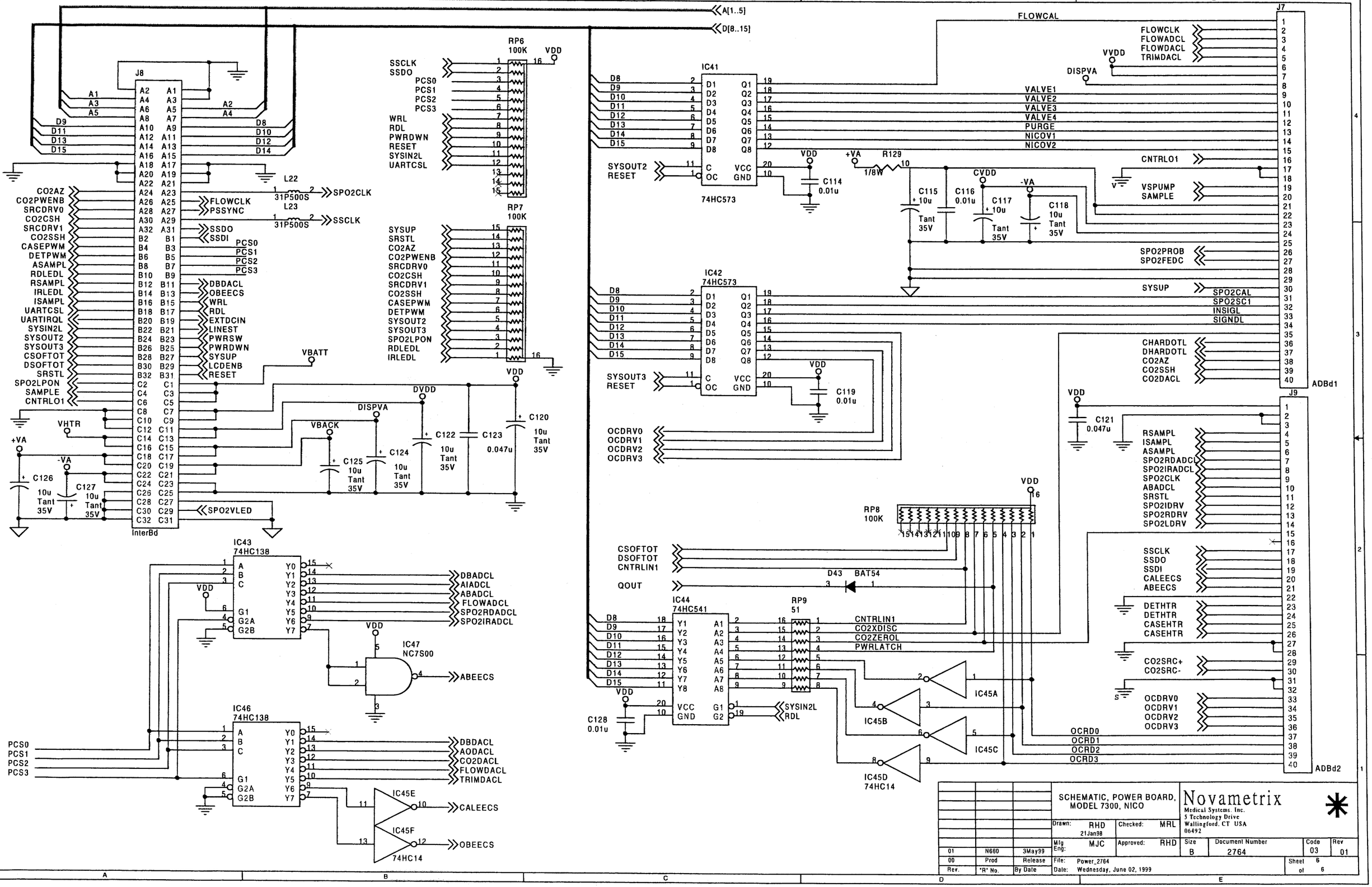
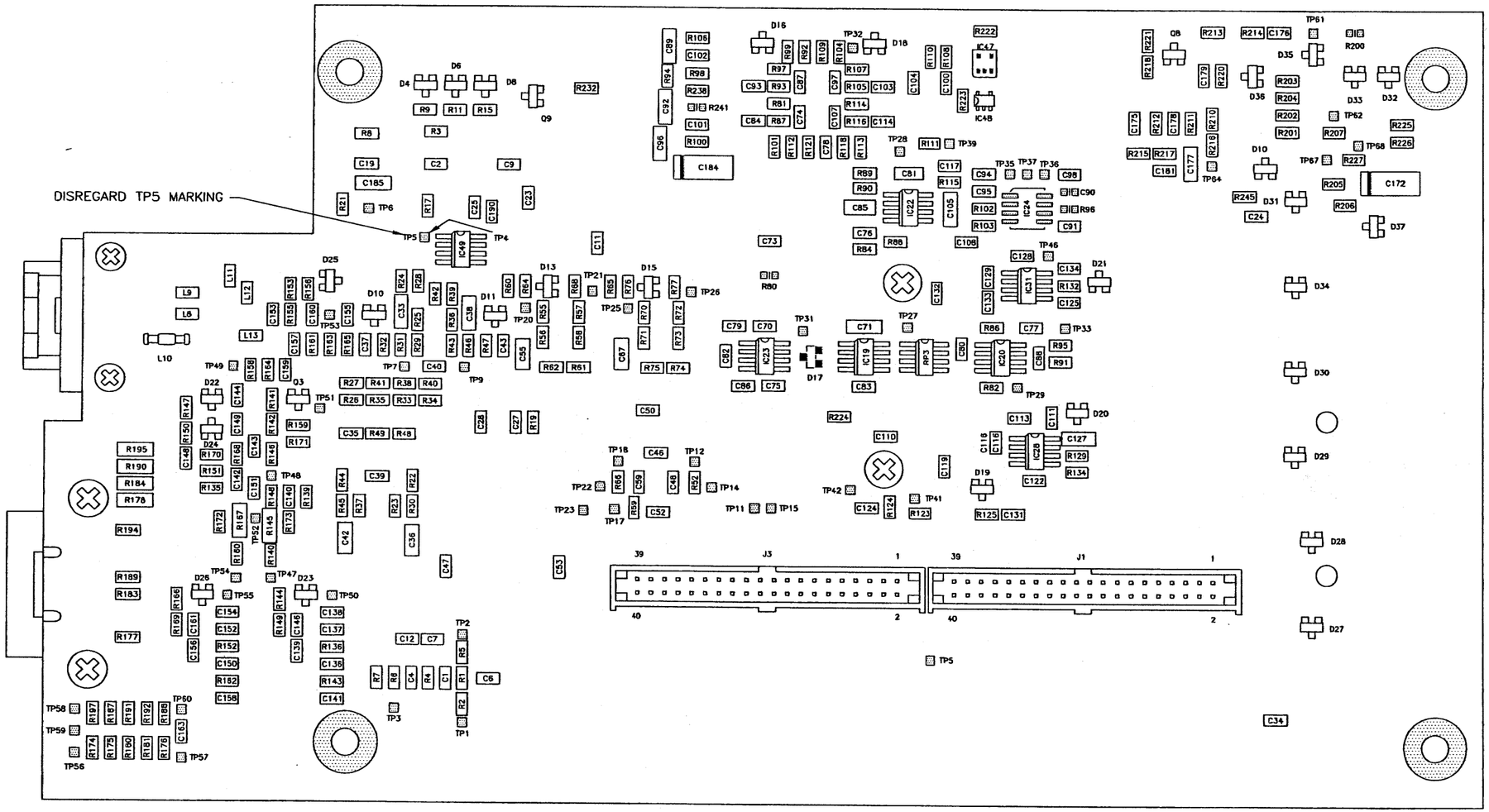

A[1..5]
D[8..15]
J8
InterBd
L22
31P500S
SPO2CLK
L23
SSCLK
SSDO
SSDI
PCS0
PCS1
PCS2
PCS3
FLOWCLK
PSSYNC
DBDACL
OBEECS
WRL
RDL
EXTDCIN
LINEST
PWRSW
PWRDWN
SYSUP
LCDENB
RESET
SPO2VLED
VBATT
DVDD
DISPVA
VBACK
VHTR
+VA
-VA
C126
C127
C120
C122
C123
C124
C125
RP6
100K
RP7
100K
IC41
74HC573
IC42
74HC573
IC43
74HC138
IC46
74HC138
IC47
NC7S00
IC45E
IC45F
74HC14
SYSOUT2
SYSOUT3
OCDRV0
OCDRV1
OCDRV2
OCDRV3
C114
C119
C121
C128
R129
1/8W
CVDD
C115
C116
C117
C118
Tant
35V
J7
ADBd1
J9
ADBd2
FLOWCAL
FLOWADCL
FLOWDACL
TRIMDACL
VALVE1
VALVE2
VALVE3
VALVE4
PURGE
NICOV1
NICOV2
CNTRLO1
VSPUMP
SAMPLE
SPO2PROB
SPO2FEDC
SPO2CAL
SPO2SC1
INSIGL
SIGNDL
CHARDOTL
DHARDOTL
CO2AZ
CO2SSH
CO2DACL
RSAMPL
ISAMPL
ASAMPL
SPO2RDADCL
SPO2IRADCL
SPO2CLK
ABADCL
SRSTL
SPO2IDRV
SPO2RDRV
SPO2LDRV
DETHTR
CASEHTR
CO2SRC+
CO2SRC-
CSOFTOT
DSOFTOT
CNTRLIN1
QOUT
D43 BAT54
IC44
74HC541
RP9
51
CO2XDISC
CO2ZEROL
PWRLATCH
IC45A
IC45B
IC45C
IC45D
74HC14
OCRD0
OCRD1
OCRD2
OCRD3
C129
0.01u
SCHEMATIC, POWER BOARD, MODEL 7300, NICO
Novametrix
Medical Systems, Inc.
5 Technology Drive
Wallingford, CT USA
06492
Drawn: RHD 21Jan98
Checked: MRL
Mfg Eng: MJC
Approved: RHD
Size B
Document Number 2764
Code 03
Rev 01
01 N660 3May99
00 Prod Release
Rev. *R* No. By Date
File: Power_2764
Date: Wednesday, June 02, 1999
Sheet 6 of 6



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REV	R NO.	DATE
01	N660	27Apr99

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES (mm)
BREAK ALL SHARP EDGES
X ±.02
XX ±.01
XXX ±.005
XXXX ±.0025
TOLERANCES
FINC ±1/64
AND ±1/4°
MATERIAL ~
FINISH ~

DRAWN	Bob Lancaster	4Nov98
CHECK	MRL	18Feb99
MFG ENGR	MJC	2/18/99
ENGR	RHD	18Feb99
PROJ ENGR	DRR	2/18/99

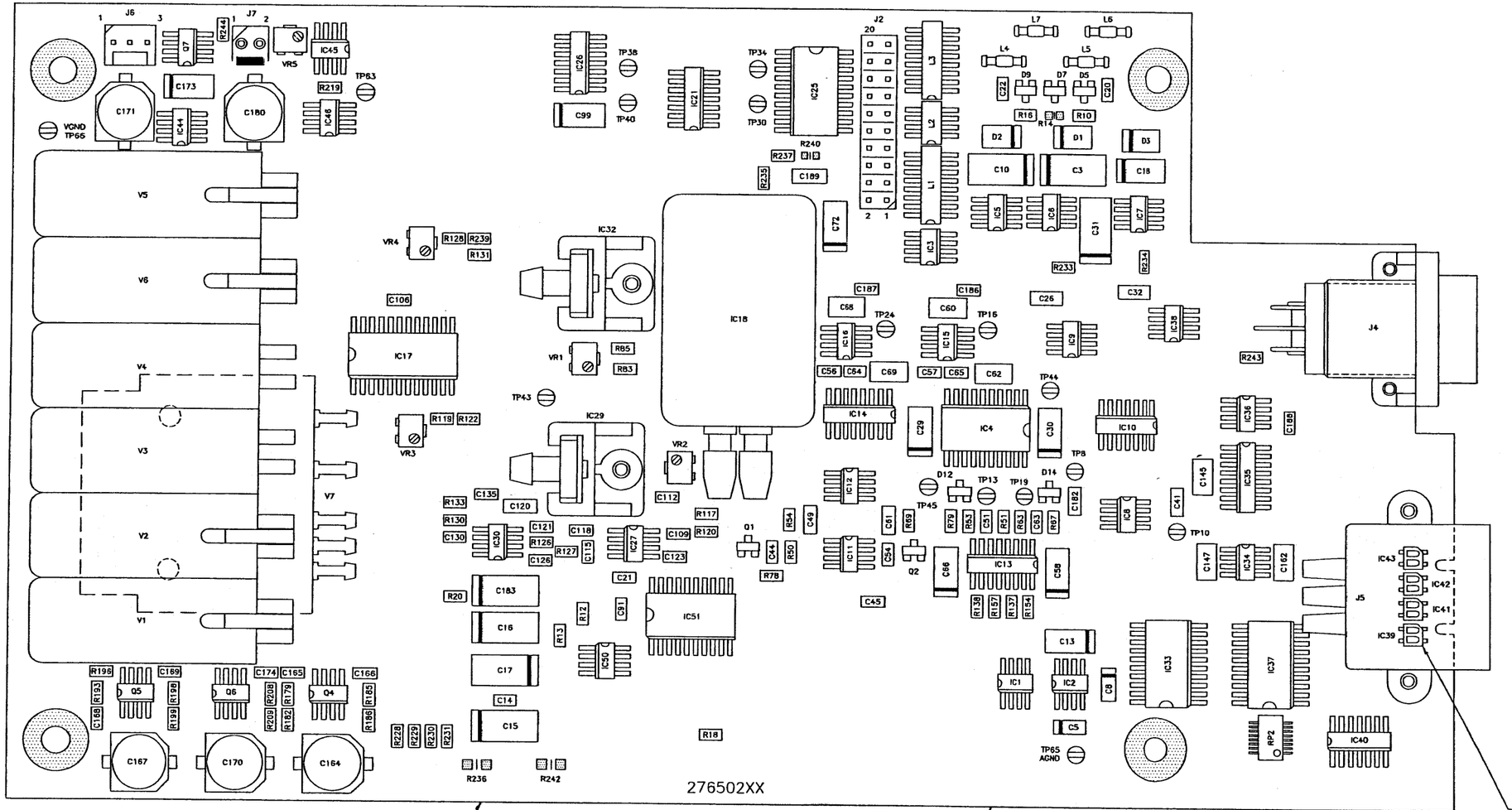
NEXT ASSY: D9226-01

NOVAMETRIX MEDICAL SYSTEMS INC.

TITLE: ANALOG BOARD ASSY, MODEL 7300 – NICO

SIZE	DRAWING NO.	CODE	REV
C	2765	01	01

SCALE: 3/1 SHEET 2 OF 4



SECURE SPO2 CONNECTOR BRACKET ASSY TO BD WITH TWO 2–56 X 1/4 LONG PAN HEAD SCREWS

SECURE FLOW CONNECTOR TO BOARD WITH 4–24 X 5/16 LONG PAN HEAD SCREWS

PRESS SEAL INTO FLOW CONNECTOR AS SHOWN.

IC39, IC41, IC42, AND IC43 ARE LOCATED BENEATH FLOW CONNECTOR

SEE SHEET 2 FOR BOTTOM SIDE ASSEMBLY

SEE SHEET 3 FOR PNEUMATIC ASSEMBLY – SCHEMATIC

SECURE TRANSDUCER SUPPORTS FOR IC29 & IC32 WITH 4–24 X 5/16 L PAN HEAD SCREW

NOTES:

1. FOR TEST PROCEDURE SEE A2765–04.
2. THE FOLLOWING COMPONENTS ARE NOT FITTED: C90, D17, IC24, IC47, J7, L13, R14, R80, R96, R200, R236, R240, R241, R242

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.X ±.02 (.X ± 0.5)
.XX ±.01
.XXX ±.005
.XXXX ±.0025
TOLERANCES
FRAC ±1/64
ANG ±1/6°
MATERIAL ~
FINISH ~

REV	R NO.	DATE
01	N660	28Apr99

	DATE
DRAWN Bob Lancaster	23Nov98
CHECK MRL	18Feb99
MFG ENGR WJC	2/18/99
ENGR RHD	18Feb99
PROJ ENGR DRR	2/18/99

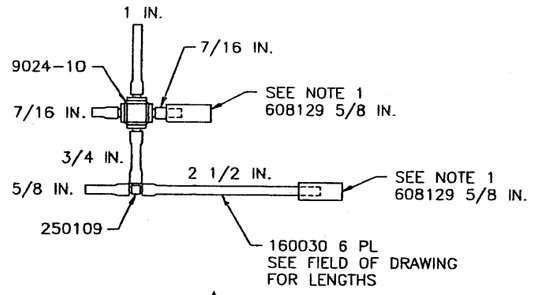
NEXT ASSY: D9228-01

NOVAMETRIX MEDICAL SYSTEMS INC.

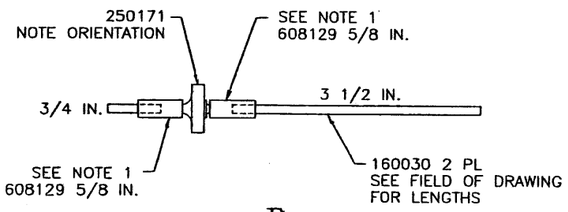
TITLE: ANALOG BOARD ASSY, MODEL 7300 – NICO

SIZE	DRAWING NO.	CODE	REV
D	2765	01	01

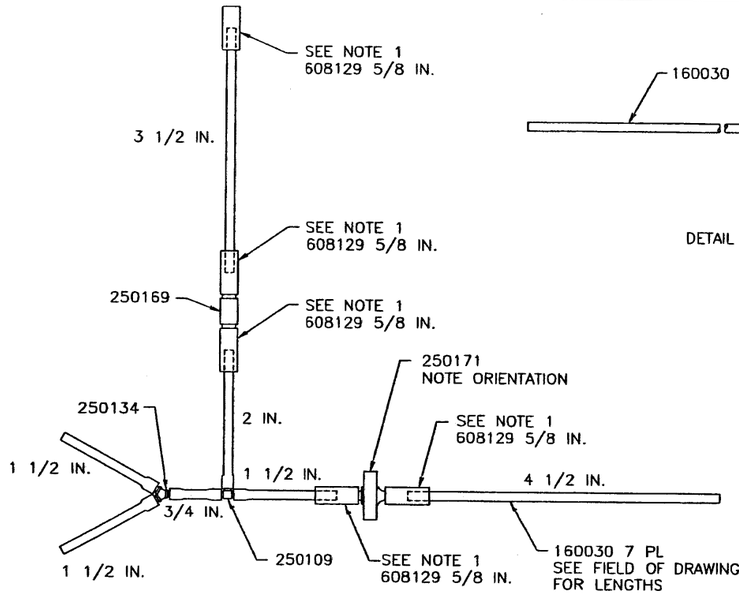
SCALE: 3/1 SHEET 1 OF 4



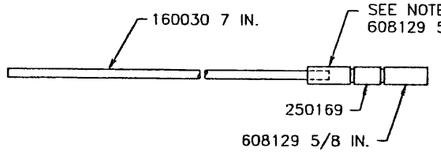
DETAIL A



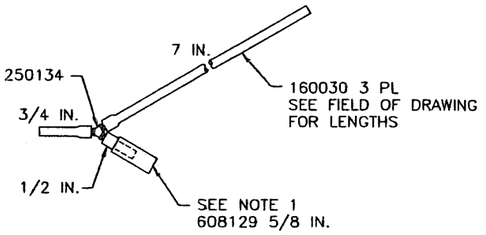
DETAIL B



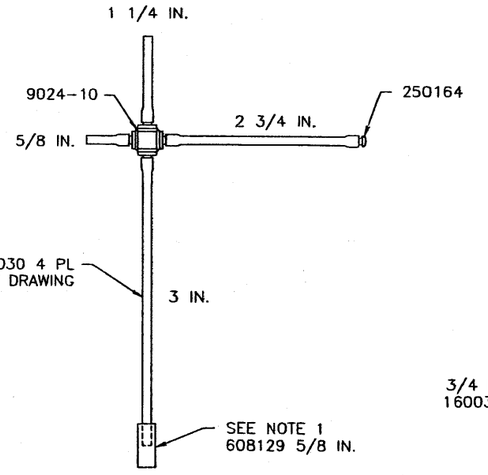
DETAIL C



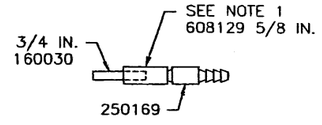
DETAIL D



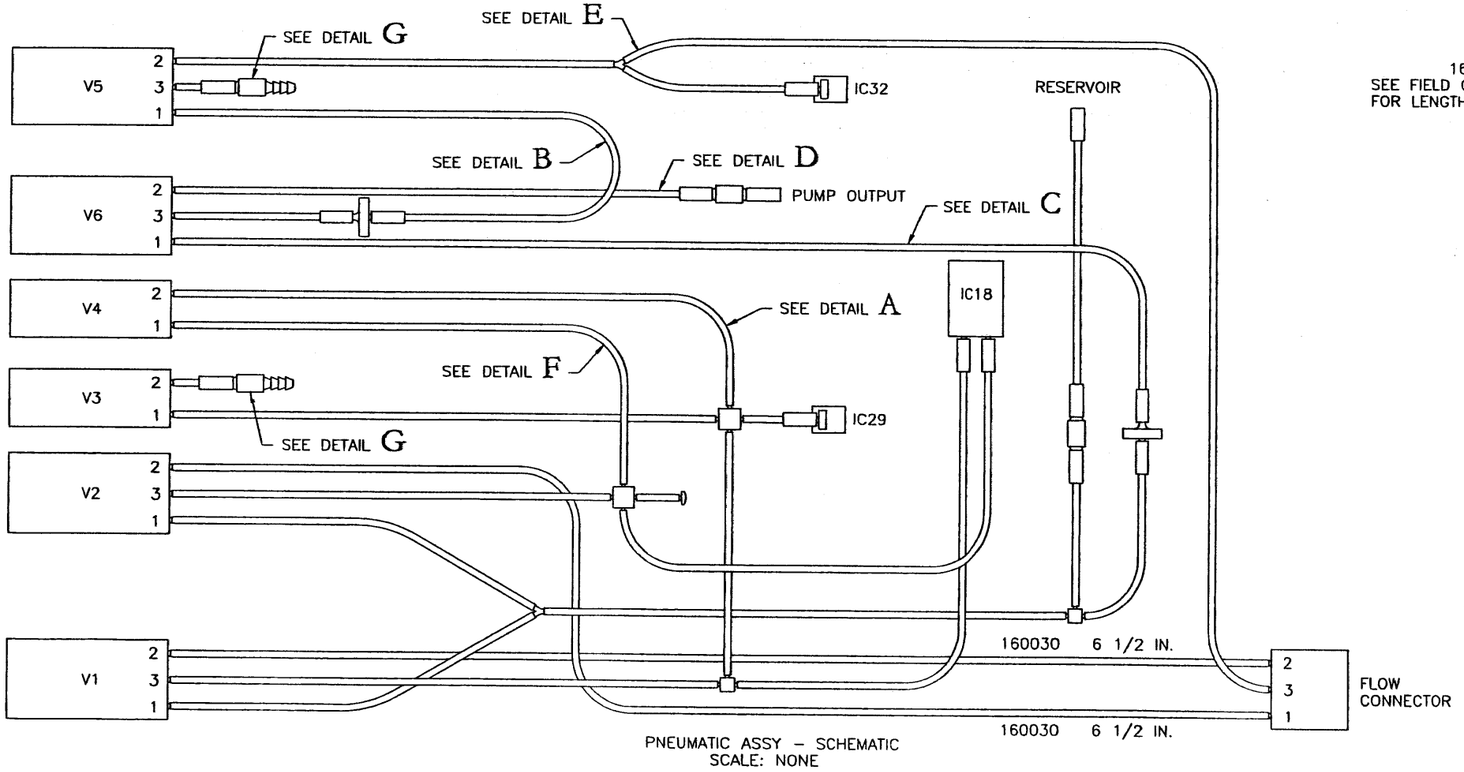
DETAIL E



DETAIL F



DETAIL G



PNEUMATIC ASSY – SCHEMATIC
SCALE: NONE

NOTES:

1. DIP END OF TUBING (160030) IN 50/50 MIX OF THF/CYCLOHEXANONE (160038) FOR ONE SECOND. BLOT END OF TUBING ON ABSORBENT TOWEL TO DRAW SOLVENT OUT OF TUBING BORE. INSERT INTO THE LARGER BORE TUBING (608129) APPROX HALF WAY. ALLOW TO DRY 10 MINUTES.

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REV	R NO.	DATE
01	N660	28Apr99

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DIMENSIONS ARE IN INCHES [mm]
TOLERANCES
.XX ±.01 [.254]
.XXX ±.005 [.127]
.XXXX ±.0025 [.064]
FRAC ±1/16
ANG ±1/4°

DRAWN	Bob Lancaster	DATE 14Dec98
CHECK	MRL	DATE 18Feb99
MFG ENGR	WJC	DATE 2/18/99
ENGR	RHD	DATE 18Feb99
PROJ ENGR	DRR	DATE 2/18/99
NEXT ASSY: D9228-01		

NOVAMETRIX MEDICAL SYSTEMS INC.

TITLE
ANALOG BOARD ASSY,
MODEL 7300 – NICO

SIZE	DRAWING NO.	CODE	REV
D	2765	01	01

SCALE: 1/1 SHEET 3 OF 4

PN	DESCRIPTION	REF DES
2765-02	FAB, ANALOG BOARD	~
D2765-03	SCHEMATIC, ANALOG BOARD	~
A2765-04	TEST PROCEDURE, ANALOG BOARD	~
B9024-10	PNEUMATIC JUNCTION BOX, FOUR-WAY	~
B9269-01	SPO2 CONNECTOR BRACKET ASSY	J4
D9270-16	FLOW CONNECTOR, RECEPTACLE, 3 PORT	J5
C9272-16	SEAL, FLOW CONNECTOR	(FOR J5)
B9328-16	SUPPORT, TRANSDUCER	(FOR IC29 & IC32)
152096	CAPACITOR, 220uF, 35V, 20%, ELECTROLYTIC	C164, C167, C170, C171, C180
154072	CAPACITOR, .1uF, 50V, 10%	C26, C32, C33, C38, C71, C89, C92, C96, C105, C120, C127, C177, C185, C189
154079	CAPACITOR, 10uF, 25V, 10%	C13, C18, C29, C30, C58, C66, C72, C99, C172, C173, C184
154086	CAPACITOR, 4.7uF, 10VDC, 20%	C5, C8
154103	CAPACITOR, .001uF, 50VDC, 10%	C51, C63, C75, C79, C102, C113, C116, C153, C188
154104	CAPACITOR, .01uF, 50VDC, 10%	C1, C2, C4, C6, C7, C9, C12, C14, C19, C20, C22, C23, C35, C39, C40, C45-C47, C50, C52, C53, C56, C57, C64, C85, C74, C80, C84, C86-C88, C93-C95, C97, C98, C100, C103, C106, C107, C110, C114, C117, C118, C122-C124, C132-C134, C136, C141-C144, C149-C151, C155, C157-C160, C165, C166, C168, C169, C174, C178, C179, C186, C187, C191
154105	CAPACITOR, 47pF, 50VDC, 5%	C48, C59, C140, C148, C192, C193
154106	CAPACITOR, 22pF, 50VDC, 5%	C112, C115, C128, C129
154108	CAPACITOR, 100pF, 50VDC, 5%	C44, C54
154111	CAPACITOR, .1uF, 16VDC, 5%	C49, C60, C61, C68, C81, C145, C147, C162
154112	CAPACITOR, .047uF, 16VDC, 10%	C11, C21, C24, C25, C27, C28, C34, C37, C43, C70, C73, C76-C78, C82, C83, C91, C101, C104, C108, C109, C111, C119, C121, C125, C126, C130, C131, C135, C137-C139, C146, C152, C154, C156, C161, C163, C175, C176, C181, C190
154116	CAPACITOR, 10uF, 35V, 10%	C3, C10, C15-C17, C31, C183
154137	CAPACITOR, .0047uF, 35V, 10%	C36, C42
154143	CAPACITOR, .01uF, 50V, 5%, 1210 STYLE	C41, C55, C62, C67, C69, C182
154139	CAPACITOR, .047uF, 35V, 10%	C85
160030	TUBING, .062 ID X .125 OD +/-.006, CLEAR	~
160038	SOLVENT, 50% CYCLOHEXANONE & 50% THF	~
180030	INDUCTOR-CAP, 4700pF, 50VDC, 2A, 3 TERMINAL	L4-L7, L10
180034	FERRITE FILTER, 4 LINE, EMI SUPPRESSION	L2
180035	FERRITE FILTER, 8 LINE, EMI SUPPRESSION	L1, L3
180056	FERRITE BEAD, 120 OHMS @ 100MHz	L8, L9, L11, L12
☆211327	CONNECTOR, 3 PIN, HEADER, .1 SP	J6
☆212501	CONNECTOR, 20 PIN, HEADER, DUAL ROW	J2
213414	CONNECTOR, 40 PIN, HEADER, ELEV, .078 SP	J1, J3
☆216029	TEST POINT, SPRING LOADED, 475°C MAX	TP8, TP10, TP13, TP16, TP19, TP24, TP30, TP34, TP38, TP40, TP43-TP45, TP63, TP65, TP66
250109	FITTING, TEE, FOR 1/16 ID TUBING, WHITE	~
250134	FITTING, Y, FOR 1/16 ID TUBING, WHITE	~
250164	FITTING, PRESS-IN PLUG, FOR 1/16 ID TUBING	~
250169	FILTER, IN LINE, 25 MICRON, FOR 1/8 ID TUBING	~
250171	CHECK VALVE, NC, .07 OD, .825 L	~

PN	DESCRIPTION	REF DES
☆250146	VALVE, SOLENOID, 5V, 0-30 PSIG, 3-WAY	V1, V2, V5, V6
☆250151	VALVE, SOLENOID, 5V, 0-30 PSIG, 2-WAY	V3, V4
281211	SCREW, 2-56 X 1/4L, SELF TAPPING	~
284008	SCREW, 4-24 X 5/16L, THD FORMING	~
474157	RESISTOR, 511 OHM, 1/8W, 1%	R178, R184, R190, R195
474175	RESISTOR, 3.92k OHM, 1/8W, 1%	R145, R167
474194	RESISTOR, 2.2M OHM, 1/16W, 5%	R35, R41
474195	RESISTOR, 511k OHM, 1/16W, 1%	R153
474197	RESISTOR, 49.9k OHM, 1/16W, 1%	R23, R24, R28, R37, R39, R42, R55, R56, R58, R70, R71, R115, R149, R169, R203, R207, R225, R227
474198	RESISTOR, 2.49k OHM, 1/16W, 1%	R110, R165
474222	RESISTOR, 10 OHM, 1/16W, 1%	R4, R5, R7, R17, R21, R94, R136-R138, R143, R146, R152, R154, R157, R162, R168, R224, R233, R234, R235
474223	RESISTOR, 49.9 OHM, 1/16W, 1%	R3, R8-R11, R15, R16, R19
474224	RESISTOR, 100 OHM, 1/16W, 1%	R29, R43, R78, R79, R85-R88, R95, R97, R100, R106, R107, R113, R116, R121, R126, R132, R133, R135, R140, R148, R160, R170-R173, R215
474225	RESISTOR, 499 OHM, 1/16W, 1%	R52, R66, R122, R131
474227	RESISTOR, 1k OHM, 1/16W, 1%	R50, R51, R53, R59, R60, R63-R65, R67, R76, R98, R103, R104, R112, R119, R128, R147, R150, R176, R181, R188, R192, R222, R223
474228	RESISTOR, 1.21k OHM, 1/16W, 1%	R210
474229	RESISTOR, 2.05k OHM, 1/16W, 1%	R156
474230	RESISTOR, 3.32k OHM, 1/16W, 1%	R32, R47
474233	RESISTOR, 10k OHM, 1/16W, 1%	R1, R2, R6, R26, R27, R72, R82, R91, R92, R101, R102, R117, R120, R163, R201, R205, R218, R220, R245
474234	RESISTOR, 20.5k OHM, 1/16W, 1%	R31, R46
474235	RESISTOR, 24.9k OHM, 1/16W, 1%	R22, R30, R44, R45, R73, R164, R213, R214
474236	RESISTOR, 33.2k OHM, 1/16W, 1%	R33, R38
474238	RESISTOR, 37.4k OHM, 1/16W, 1%	R49
474239	RESISTOR, 75k OHM, 1/16W, 1%	R89, R90, R123, R127, R129, R134, R216, R217
474240	RESISTOR, 100k OHM, 1/16W, 1%	R12, R13, R18, R25, R34, R36, R40, R68, R77, R81, R93, R99, R105, R109, R114, R118, R139, R151, R158, R159, R175, R177, R180, R182, R183, R186, R187, R189, R191, R194, R196, R199, R202, R204, R206, R209, R221, R226, R228-R232, R244
474241	RESISTOR, 150k OHM, 1/16W, 1%	R84, R125, R130, R141, R144, R166, R197, R211, R212
474242	RESISTOR, 249k OHM, 1/16W, 1%	R48, R108, R155, R161, R174
474245	RESISTOR, 1M OHM, 1/16W, 1%	R54, R69, R179, R185, R193, R198, R208
474251	RESISTOR, 61.9k OHM, 1/16W, 1%	R142
474256	RESISTOR, ZERO OHM, 0603 STYLE	R20, R237-R239, R243
474259	RESISTOR, 15k OHM, 1/16W, 1%	R62, R75, R111, R124
474261	RESISTOR, 7.5k OHM, 1/16W, 1%	R57, R61, R74
474265	RESISTOR, 1 OHM, 1/4W, 1%	R219
474271	RESISTOR, 402 OHM, 1/16W, 1%	R83

PN	DESCRIPTION	REF DES
474310	RESISTOR PACK, 10k OHM, .1W, 2%, 8 PIN, DIP	RP3
474316	RESISTOR PACK, 100k OHM, 5%, 16 PIN, DIP	RP2
475042	POTENTIOMETER, 50k OHM, 10%, TOP ADJ	VR5
475051	POTENTIOMETER, 10k OHM, 10%, TOP ADJ	VR1-VR4
481546	DIODE, SWITCHING	D25
481547	DIODE, HOT CARRIER SCHOTTKY	D12, D14, D32, D35, D37
481548	DIODE, RECTIFIER	D1-D3
481555	DIODE, DUAL SWITCHING	D4-D11, D13, D15, D19-D24, D26-D31, D33, D34, D36
481556	DIODE, DUAL SCHOTTKY, COMMON CATHODE	D16, D18
483019	TRANSISTOR, PNP, SOT-23	Q9
484061	TRANSISTOR, NPN, SOT-23	Q8, Q10
484540	VOLTAGE REGULATOR, POSITIVE, ADJ, SO-8	IC45
484542	VOLTAGE REGULATOR, -5V OUT, 5%, SOP-8	IC7
484543	VOLTAGE REGULATOR, +5V OUT, 5%, SOP-8	IC6
484544	VOLTAGE REGULATOR, -12V OUT, 5%, SOP-8	IC3
484545	VOLTAGE REGULATOR, +12V OUT, 5%	IC49, IC50
485532	TRANSISTOR, N-CHANNEL ENHAN MODE	Q1-Q3
485540	TRANSISTOR, DUAL P-CHANNEL ENHAN MODE	Q4, Q5, Q6
485543	TRANSISTOR, MOSFET, N-CHAN & P-CHAN	Q7

PN	DESCRIPTION	REF DES
486042	IC, SERIAL 4k EEPROM, 8 PIN	IC5
486314	IC, OCTAL BUFFER/LINE DRIVER-RECEIVER	IC51
486324	IC, QUAD SPST CMOS ANALOG SWITCH	IC35
486332	IC, 20-BIT A TO D CONVERTER	IC33, IC37
486340	IC, 12 BIT A TO D CONVERTER, 20 PIN	IC4
486362	IC, 20 BIT A TO D CONVERTER, W SERIAL OUT	IC25
486366	IC, DIGITAL POTENTIOMETER, 10k OHM, 24 PIN	IC17
486481	IC, QUAD 8-BIT D-TO-A CONVERTER, 14 PIN	IC26
486785	IC, QUAD VOLTAGE COMPARATOR	IC10, IC40
486790	IC, DUAL OP AMPLIFIER, HIGH SPEED, LOW PWR	IC12, IC15, IC16, IC38
486796	IC, DUAL OP AMP, RAIL TO RAIL, 8 PIN	IC8, IC9, IC22, IC46
486805	IC, DUAL VOLTAGE COMPARATOR	IC44
486807	IC, QUAD SAMPLE & HOLD AMP, 16 PIN	IC13
486821	IC, FET-INPUT OP AMP, LOW POWER, 8 PIN	IC2, IC11, IC20, IC30
486825	IC, OP AMP, LOW POWER, RAIL TO RAIL	IC48
486829	IC, DUAL 12-BIT D TO A CONVERTER, 16 PIN	IC14
486831	IC, PRECISION 2.5V REF, 20mA MIN OUT, 8 PIN	IC1
486832	IC, PRECISION 5V REF, LOW NOISE, 8 PIN	IC19
486833	IC, 4-INPUT & OUTPUT OP AMP, 14 PIN	IC21
487078	IC, DUAL BIFET OP AMPLIFIER	IC34, IC36
487115	IC, INSTR AMP, LOW POWER, 8 PIN	IC23, IC27, IC28, IC31
487124	IC, REFLECTIVE SENSOR, HIGH SPEED, 4 PIN	IC39, IC41-IC43
487129	IC, ABSOLUTE PRESSURE SENSOR, 15 PSI, 4 PIN	IC29
☆487136	IC, PRESSURE TRANSDUCER, 0-5 PSIG, 4 PIN	IC32
☆487137	IC, PRESSURE SENSOR, 1 IN. H2O, 10 PIN	IC18
508129	TUBING, POLYURETHANE, 3/16 OD X 3/32 ID	~

NOTES:

☆ DENOTES THRU HOLE COMPONENTS.

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TOLERANCES
.XX ±.01 [.254]
.XXX ±.005 [.127]
.XXXX ±.0025 [.064]
FRAC ±1/64
ANG ±1/4°

REV	R NO.	DATE
01	N660	27Apr99

	DRAWN	DATE
	Bob Lancaster	4Nov98
	CHECK	DATE
	MRL	18Feb99
	MFG ENGR	DATE
	MJC	2/18/99
	ENGR	DATE
	RHD	18Feb99
	PROJ ENGR	DATE
	DRR	2/18/99

NEXT ASSY: D9225-01

NOVAMETRIX MEDICAL SYSTEMS INC.

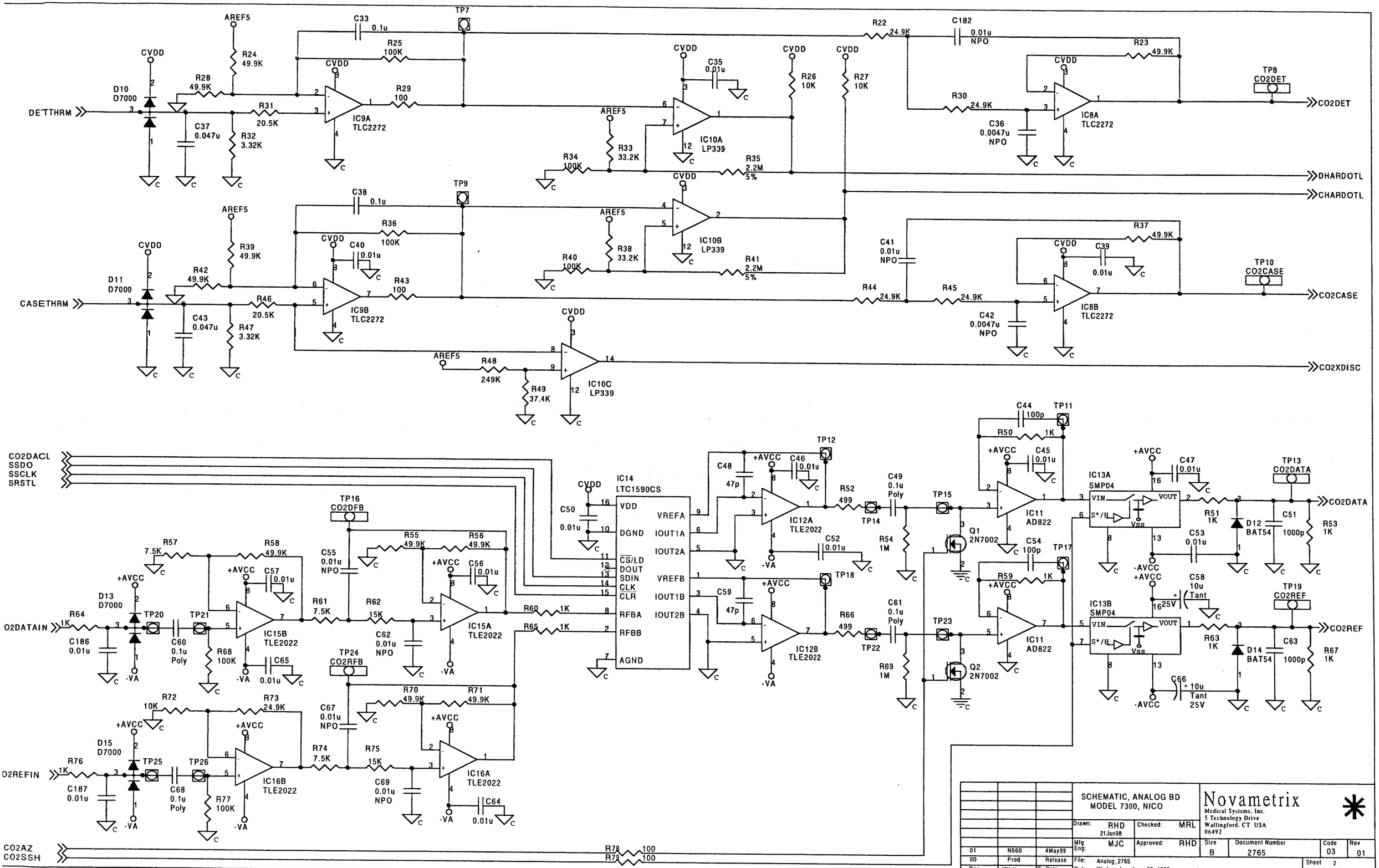
TITLE
ANALOG BOARD ASSY, MODEL 7300 - NICO

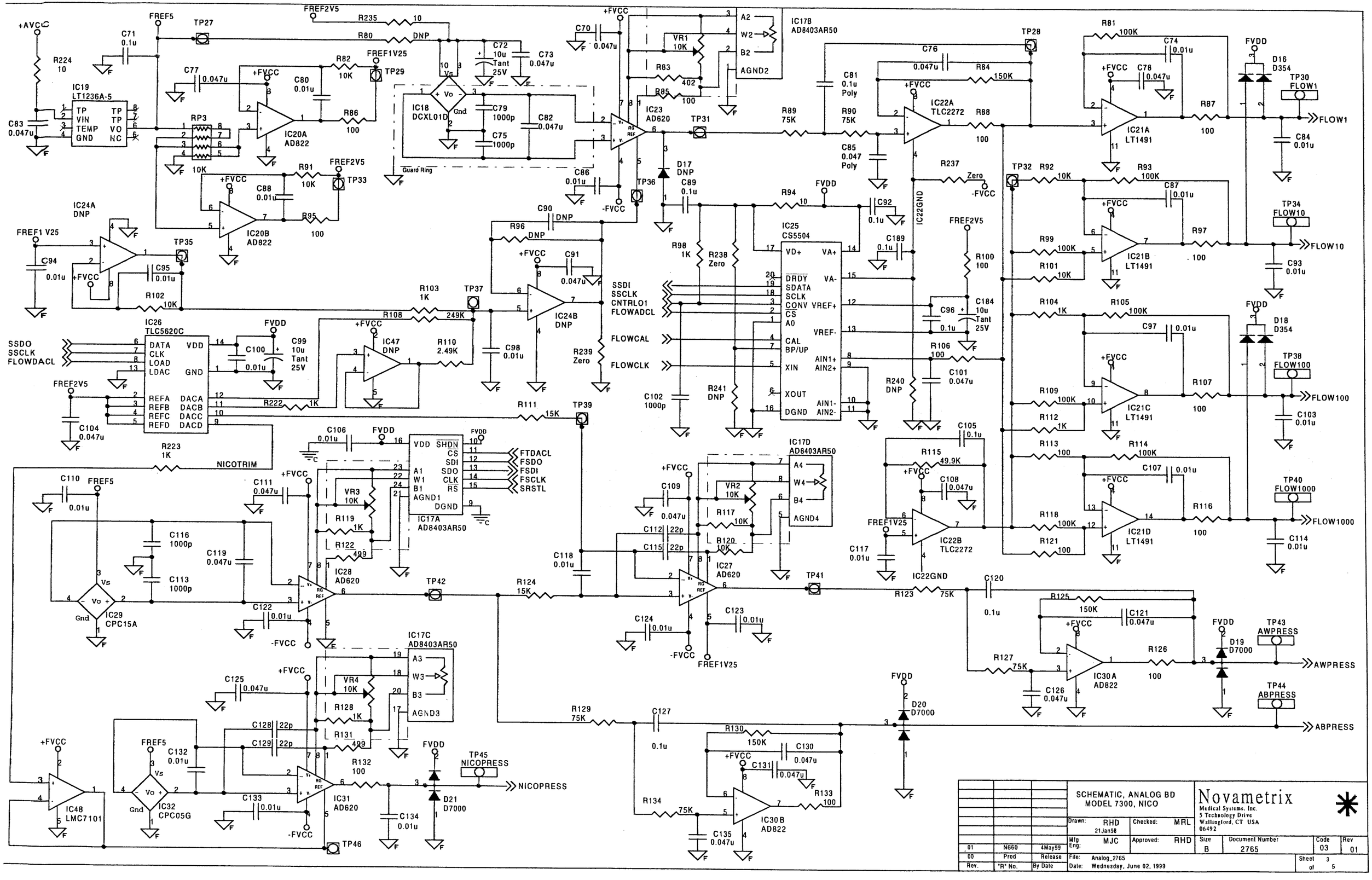
SIZE	DRAWING NO.	CODE	REV
D	2765	01	01

SCALE: NONE SHEET 4 OF 4

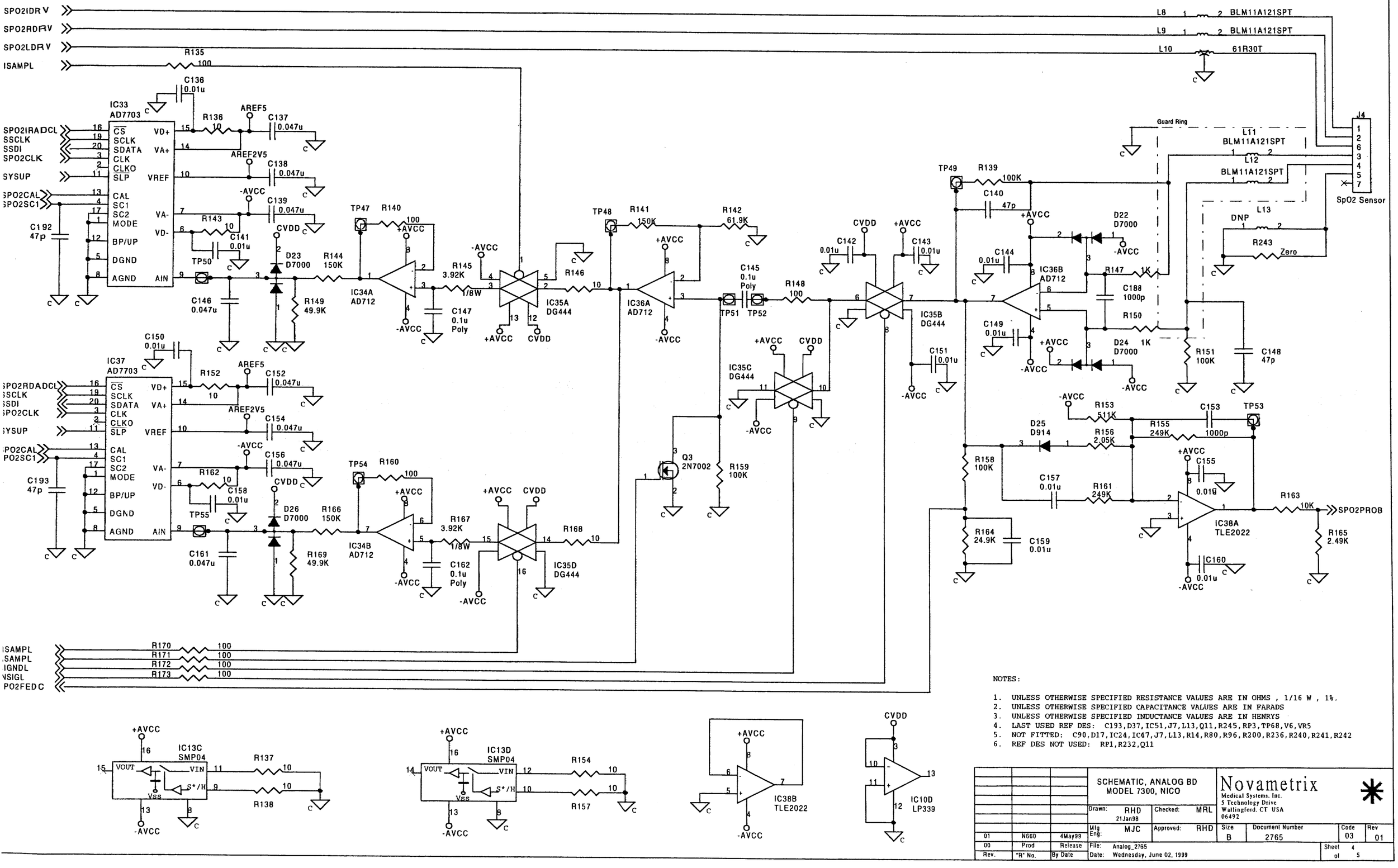
J1
ADBd1
R228 100K
R229 100K
R230 100K
R231 100K
VDD
FLOWCAL
FLOWCLK
FLOWADCL
FLOWDACL
TRIMDACL
VVDD
DISPVA
VALVE1
VALVE2
VALVE3
VALVE4
PURGE
NICOV1
NICOV2
CNTRLO1
VSPUMP
SAMPLE
SPO2PROB
SPO2FEDC
CO2XDISC
CHARDOTL
DHARDOTL
R12 100K
R13 100K
J3
ADBd2
VDD
C21 0.047u
SRSTL
R18 100K
SPO2IDRV
SPO2RDRV
SPO2LDRV
CO2ZEROL
CO2SPANL
SSCLK
SSDO
SSDI
CALEECS
ABEECS
DETHTR
DETHTR
CASEHTR
CASEHTR
CO2SRC+
CO2SRC-
OCDRV0
OCDRV1
OCDRV2
OCDRV3
OCRD0
OCRD1
OCRD2
OCRD3
+AVCC
IC6 78L05
Vi Vo GND GND GND GND NC NC
C25 0.047u
TP4
R17 10
FVDD
R233 10
+FVCC
C26 0.1u
R20 Zero
TP5
AVCCIN
IC50 78L12
+AVCC
C6 0.01u
IC1 LT1460-2.5
TP VIN TEMP GND TP VO NC
CVDD
-VA
C17 10u Tant 35V
C16 10u Tant 35V
C14 0.01u
C15 10u Tant 35V
C183 10u Tant 35V
R236 DNP
R242 DNP
VDD
RP2 100K
SSCLK
SSDO
SYSUP
SPO2CAL
SPO2SC1
INSIGL
SIGNDL
CO2AZ
CO2SSH
CO2DACL
IC5 93C66
ABEECS
SSCLK SSDO SSDI
CS SK DI DO VDD DC ORG GND
C23 0.01u
RSAMPL
ISAMPL
ASAMPL
SPO2RDADCL
SPO2IRADCL
SPO2CLK
ABADCL
TP6
R21 10
-AVCC
C185 0.1u
IC7 79L05
R234 10
-FVCC
C31 10u Tant 35V
C32 0.1u
IC51 74HC541
TRIMDACL
SSCLK
SSDI
SSDO
FTDACL
FSCLK
FSDI
FSDO
C191 0.01u
R1 10K
R2 10K
TP1
AREF5
C1 0.01u
C4 0.01u
C5 4.7u Tant 10V
R5 10
TP2
IC2A AD822
R4 10
R6 10K
TP3
AREF2V5
C7 0.01u
C8 4.7u Tant 10V
R7 10
IC2B AD822
TP65 AGND
C12 0.01u
C13 10u Tant 25V
C20 0.01u
D4 D7000
D5
D6
D7 D7000
SSCLK
CALEECS
SSDO
SSDI
R9 49.9
R10 49.9
R11 49.9
R14 DNP
Q9 T2907A
L2 F0418-1SR
R232 100K
SSDI
IC4 TLC2543
CO2DATA CO2REF CO2CASE CO2DET ABPRESS AWPRESS FLOW1 FLOW10 FLOW100 FLOW1000 NICOPRESS
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 DOUT REF+ REF- CS ADDIN IOCLK EOC VCC GND
FREF2V5
R19 49.9
ABADCL
SSDO
SSCLK
FVDD
C27 0.047u
C29 10u Tant 25V
C28 0.047u
C30 10u Tant 25V
DETTHRM
R8 49.9
C19 0.01u
C18 10u Tant 25V
D3 EGL41B
VDD
AVCCIN
R3 49.9
C2 0.01u
C3 10u Tant 35V
D1 EGL41B
IC49 78L12
Vo Vi GND GND GND GND NC NC
C190 0.047u
CASETHRM
C9 0.01u
C10 10u Tant 35V
D2 EGL41B
IC3 79L12
-VA
Vo Vi NC Vi NC Vi GND Vi
C11 0.047u
CO2DATAIN
CO2REFIN
Guard Ring
L1 F0818-1SR
J2
Capnostat
D8 D7000
D9 D7000
C22 0.01u
CO2ZEROL
CO2SPANL
R15 49.9
R16 49.9
L3 F0818-1SR
DETHTR
L4 61R30T
CASEHTR
L5 61R30T
CO2SRC+
L6 61R30T
CO2SRC-
L7 61R30T

			SCHEMATIC, ANALOG BOARD MODEL 7300, NICO	Novametrix Medical Systems, Inc. 5 Technology Drive Wallingford, CT USA 06492			
			Drawn: RHD 21Jan98	Checked: MRL			
			Mfg Eng: MJC	Approved: RHD	Size B	Document Number 2765	Code 03 / Rev 01
01	N660	4May99	File: Analog_2765				Sheet 1 of 5
00	Prod	Release	Date: Wednesday, June 02, 1999				
Rev.	"R" No.	By Date					


DETTHRM
CASETHRM
O2DATAIN
O2REFIN
CO2DACL
SSDO
SSCLK
SRSTL
CO2AZ
CO2SSH
AREF5
CVDD
+AVCC
-VA
IC9A TLC2272
IC10A LP339
IC8A TLC2272
IC9B TLC2272
IC10B LP339
IC8B TLC2272
IC10C LP339
IC14 LTC1590CS
IC12A TLE2022
IC12B TLE2022
IC15B TLE2022
IC15A TLE2022
IC16B TLE2022
IC16A TLE2022
IC11 AD822
IC13A SMP04
IC13B SMP04
Q1 2N7002
Q2 2N7002
D10 D7000
D11 D7000
D13 D7000
D15 D7000
D12 BAT54
D14 BAT54
TP7
TP8 CO2DET
TP9
TP10 CO2CASE
TP11
TP12
TP13 CO2DATA
TP14
TP15
TP16 CO2DFB
TP17
TP18
TP19 CO2REF
TP20
TP21
TP22
TP23
TP24 CO2RFB
TP25
TP26
CO2DATA
CO2REF
DHARDOTL
CHARDOTL
CO2CASE
CO2XDISC
R22 24.9K
R23 49.9K
R24 49.9K
R25 100K
R26 10K
R27 10K
R28 49.9K
R29 100
R30 24.9K
R31 20.5K
R32 3.32K
R33 33.2K
R34 100K
R35 2.2M 5%
R36 100K
R37 49.9K
R38 33.2K
R39 49.9K
R40 100K
R41 2.2M 5%
R42 49.9K
R43 100
R44 24.9K
R45 24.9K
R46 20.5K
R47 3.32K
R48 249K
R49 37.4K
R50 1K
R51 1K
R52 499
R53 1K
R54 1M
R55 49.9K
R56 49.9K
R57 7.5K
R58 49.9K
R59 1K
R60 1K
R61 7.5K
R62 15K
R63 1K
R64 1K
R65 1K
R66 499
R67 1K
R69 1M
R70 49.9K
R71 49.9K
R72 10K
R73 24.9K
R74 7.5K
R75 15K
R76 1K
R77 100K
R78 100
R79 100
C33 0.1u
C35 0.01u
C36 0.0047u NPO
C37 0.047u
C38 0.1u
C39 0.01u
C40 0.01u
C41 0.01u NPO
C42 0.0047u NPO
C43 0.047u
C44 100p
C45 0.01u
C46 0.01u
C47 0.01u
C48 47p
C49 0.1u Poly
C50 0.01u
C51 1000p
C52 0.01u
C53 0.01u
C54 100p
C55 0.01u NPO
C56 0.01u
C57 0.01u
C58 10u Tant 25V
C59 47p
C60 0.1u Poly
C61 0.1u Poly
C62 0.01u NPO
C63 1000p
C64 0.01u
C65 0.01u
C66 10u Tant 25V
C67 0.01u NPO
C68 0.1u Poly
C69 0.01u NPO
C182 0.01u NPO
C186 0.01u
C187 0.01u
SCHEMATIC, ANALOG BD
MODEL 7300, NICO
Novametrix
Medical Systems, Inc.
5 Technology Drive
Wallingford, CT USA
06492
Drawn: RHD 21Jan98
Checked: MRL
Mfg Eng: MJC
Approved: RHD
Size B
Document Number 2765
Code 03
Rev 01
01 N660 4May99
00 Prod Release
Rev. "R" No. By Date
File: Analog_2765
Date: Wednesday, June 02, 1999
Sheet 2 of 5



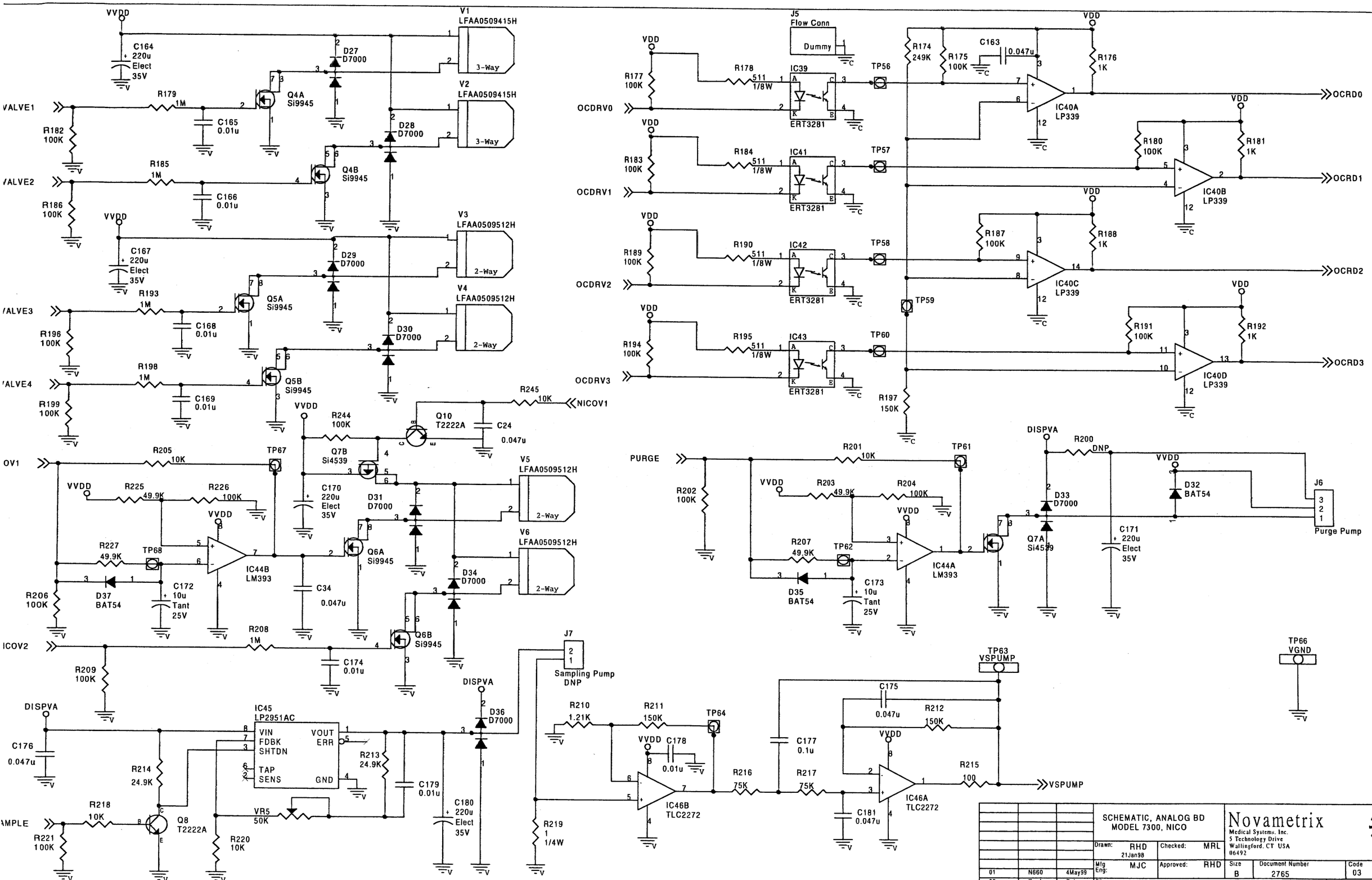
			SCHEMATIC, ANALOG BD MODEL 7300, NICO		Novametrix Medical Systems, Inc. 5 Technology Drive Wallingford, CT USA 06492
			Drawn: RHD 21Jan98	Checked: MRL	
			Mfg Eng: MJC	Approved: RHD	Size B / Document Number 2765 / Code 03 / Rev 01
01	N660	4May99	File: Analog_2765		Sheet 3 of 5
00	Prod	Release	Date: Wednesday, June 02, 1999		
Rev.	"R" No.	By Date			



NOTES:

1. UNLESS OTHERWISE SPECIFIED RESISTANCE VALUES ARE IN OHMS , 1/16 W , 1%.
2. UNLESS OTHERWISE SPECIFIED CAPACITANCE VALUES ARE IN FARADS
3. UNLESS OTHERWISE SPECIFIED INDUCTANCE VALUES ARE IN HENRYS
4. LAST USED REF DES: C193,D37,IC51,J7,L13,Q11,R245,RP3,TP68,V6,VR5
5. NOT FITTED: C90,D17,IC24,IC47,J7,L13,R14,R80,R96,R200,R236,R240,R241,R242
6. REF DES NOT USED: RP1,R232,Q11

			SCHEMATIC, ANALOG BD MODEL 7300, NICO			Novametrix	
						Medical Systems, Inc. 5 Technology Drive Wallingford. CT USA 06492	
			Drawn: RHD 21Jan98	Checked: MRL			
			Mfg Eng: MJC	Approved: RHD	Size B	Document Number 2765	Code 03 / Rev 01
01	N660	4May99	File: Analog_2765				Sheet 4 of 5
00	Prod	Release	Date: Wednesday, June 02, 1999				
Rev.	"R" No.	By Date					



			SCHEMATIC, ANALOG BD MODEL 7300, NICO		
			Drawn: RHD 21Jan98	Checked: MRL	
			Mfg Eng: MJC	Approved: RHD	
01	N660	4May99	File: Analog_2765		
00	Prod	Release	Date: Wednesday, June 02, 1999		
Rev.	"R" No.	By Date			

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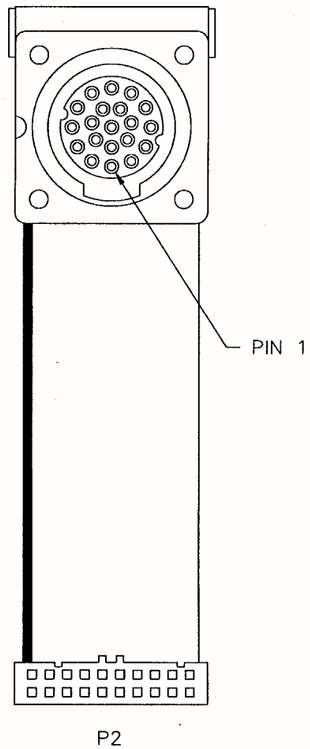
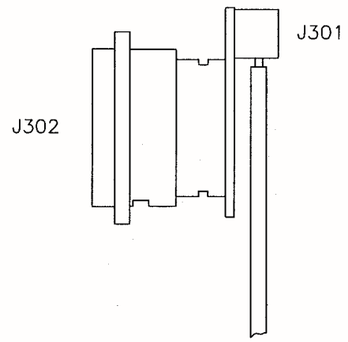
Wallingford, CT USA
06492

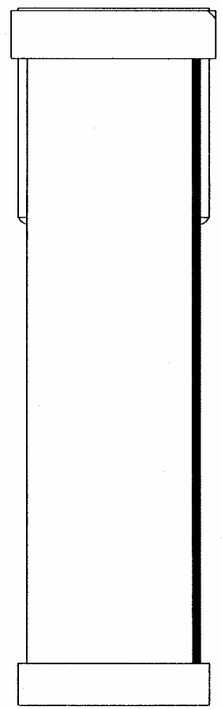
Size	Document Number	Code	Rev
B	2765	03	01

Sheet 5 of 5

PN	DESCRIPTION	REF DES
2766-02	FAB, CO2 INPUT BOARD	~
C2766-03	SCHEMATIC, CO2 INPUT BOARD	~
212527	CONNECTOR, 20 PIN, RECEPTACLE	J302
600055	RIBBON CABLE ASSY, 20 PIN, 4 IN. L	J301







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REV	R NO.	DATE

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES (mm)
BREAK ALL SHARP EDGES
.X ±.02 TOLERANCES
.XX ±.01
.XXX ±.005 FRAC ±1/64
.XXXX ±.0025 ANG ±1/4°
MATERIAL ~
FINISH ~

DRAWN	Bob Lancaster	30Nov98
CHECK	MRL	21DEC98
MFG ENGR		15DEC98
ENGR		15DEC98
PROJ ENGR		21Dec98

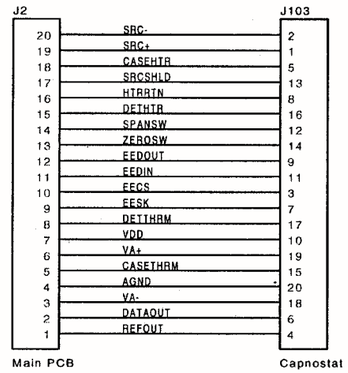
NEXT ASSY: D9226-01

NOVAMETRIX MEDICAL SYSTEMS INC.

TITLE: CO2 INPUT BOARD ASSY, MODEL 7300 – NICO

SIZE	DRAWING NO.	CODE	REV
C	2766	01	00

SCALE: 2/1 SHEET 1 OF 1



			SCHEMATIC, CO2 INPUT BOARD		Novametrix Medical Systems, Inc. 5 Technology Drive Wallingford, CT USA 06492		
			Drawn: RHD 15Feb99	Checked MRL			
			Mfg Eng MJC	Approved: RHD 2/23/99	Size B	Document Number 2766	Code 03	Rev 00
00	Prod	Release	File: 2766300				Sheet 1 of 1
Rev.	"R" No.	By Date	Date: Tuesday, February 23, 1999				